AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 3, No. 27. WEEKLY. | NEW YORK, JULY 3, 1880. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

Presses for Working Sheet Metals.

One of the prominent industries of this country is the manufacture of various articles in sheet metals, and for this trade a few firms have made a specialty of machinery adapted for producing work economically and rapidly. We illustrate herewith two presses manufactured by the Ferracute Machine Company, of Bridgeton, New Jersey, who are prominent among the manufacturers in this line of tools.

Fig. 1 shows a foot press designed for any general work, such as cutting out and forming up tops and bottoms for cans of all kinds, cutting out tin-ware and for punching any light sheet iron work. It has a frame *A*, mounted on three legs, on which hook shelves *B, B*, to hold the sheets of tin. The hole through the bed is square, and over it lies a removable bolster-plate *E*, with a five inch round hole for light work. The slide-bar *D*, is of dove tail section, six inches wide, and works in adjustable bearing twelve inches long. It has a slot through its center in which works a friction roller attached to the end of main lever *C*. The latter has adjustable weights at *F*, to be put on for heavy weight, and is driven from treadle *H*, by pitman *G*, which has 21 inches adjustment in length. This can be set very accurately by the swivel, which locks with a hand wheel, and requires no wrench. The treadle has a rubber bumper at *K*, and the "treadle-stop" *L*, the same. The latter is adjustable by a handle nut at *M*, by which the treadle can be set to any length of stroke desired. It is suitable for six inch combination dies and other lighter work. On account of the accuracy in slide bearings, &c., it is also particularly adapted for cutting any irregular shapes in tin or other light sheet metals, up to eight inches square. It is provided with differential die clamps, *N, N*, which are made to adjust sidewise to suit different widths of dies. A hollow bolt or sleeve is secured in a slot through the bed and bolster-plate by a large nut underneath, and on its lower end has a screw of nine threads per inch, on which runs a hand wheel *O*. Through this sleeve slides a hardened steel bolt with a hooked head at the top, and at the bottom a screw thread of ten per inch, running on which is a flanged nut. The steel bolts being swung around with their heads over the die and allowed to drop upon it, the wheels, *O, O*, are run down until they strike the flanged nuts. The latter then revolve with them, but do not descend quite so fast, owing to the varying pitch of screws. This "differential" action tightens the die with great force. The wheels leave the nuts and run up rapidly on their single screws when it is wished to relieve the pressure. This clamp is durable and simple, consisting of but 4 working pieces. The hole in the bed can be enlarged to 8x14 inches, intersected by a 10½ inch round hole if desired. The frame can also be heightened, giving 6 inches more room than usual under the slide bar. This is useful for bending up square can bodies.

Fig. 2 shows a power-drawing press for making deep edged work in tin, thin sheet iron, copper or brass. It will cut and draw heavy lantern and lamp work, rim covers (for pails, &c.,) tea-pot breasts, butter dishes, pie plates, 1, 1½ and 2 quart (so called) milk pans, or any other work in tin, thin sheet iron, or brass, not more than 2 inches deep by 10 inches diameter, or if only 1 inch deep up to 12 inch diameter, one at a time. Where 2 blanks are drawn at once it will make up to 1 quart pans. The operation of the press is as follows: The outer and inner slide-bars descend together until the dies have cut the outer one, stopping as soon as the "holding" die reaches the blank, while the inner one, with the punch attached, continues to the bottom of its stroke. As soon as the work is done they both return to their upper position. The outer slide-bar is driven down by two steel cams resting on steel rollers, and the inner slide-bar or plunger by an eccentric which gives a positive motion in both directions. The springs (which are set with screw adjustments) merely raise the weight of the outer slide-bar, and as they are amply large and long the slide-bar cannot "stick down." The plate on lower end of outer slide-bar, to which upper die fastens, is arranged with a screw sleeve for adjustment, and with three bolts which can be set separately so that the holding surface of the upper die is brought into a parallel plane with that of the lower, thus causing the work to be drawn evenly all around. The inner slide-bar or plunger is arranged so it can be revolved to any desired position and locked after the dies are set. This is a great advantage for oval, square, or irregular shaped work. To those not acquainted with the "drawing" process it may be interesting to know that it consists in holding the "blank" of sheet metal between 2 flat surfaces under pressure (sometimes several tons), whilst the central descending punch draws it from between them in a conical or cylindrical shape, leaving the sides without wrinkles—the metal being "upset" or thickened circumferentially, and stretched or drawn out radially, as the outer parts are reduced in diameter.

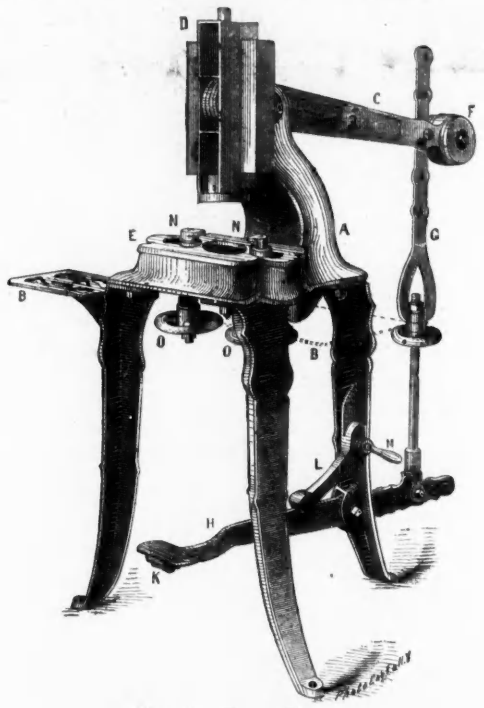
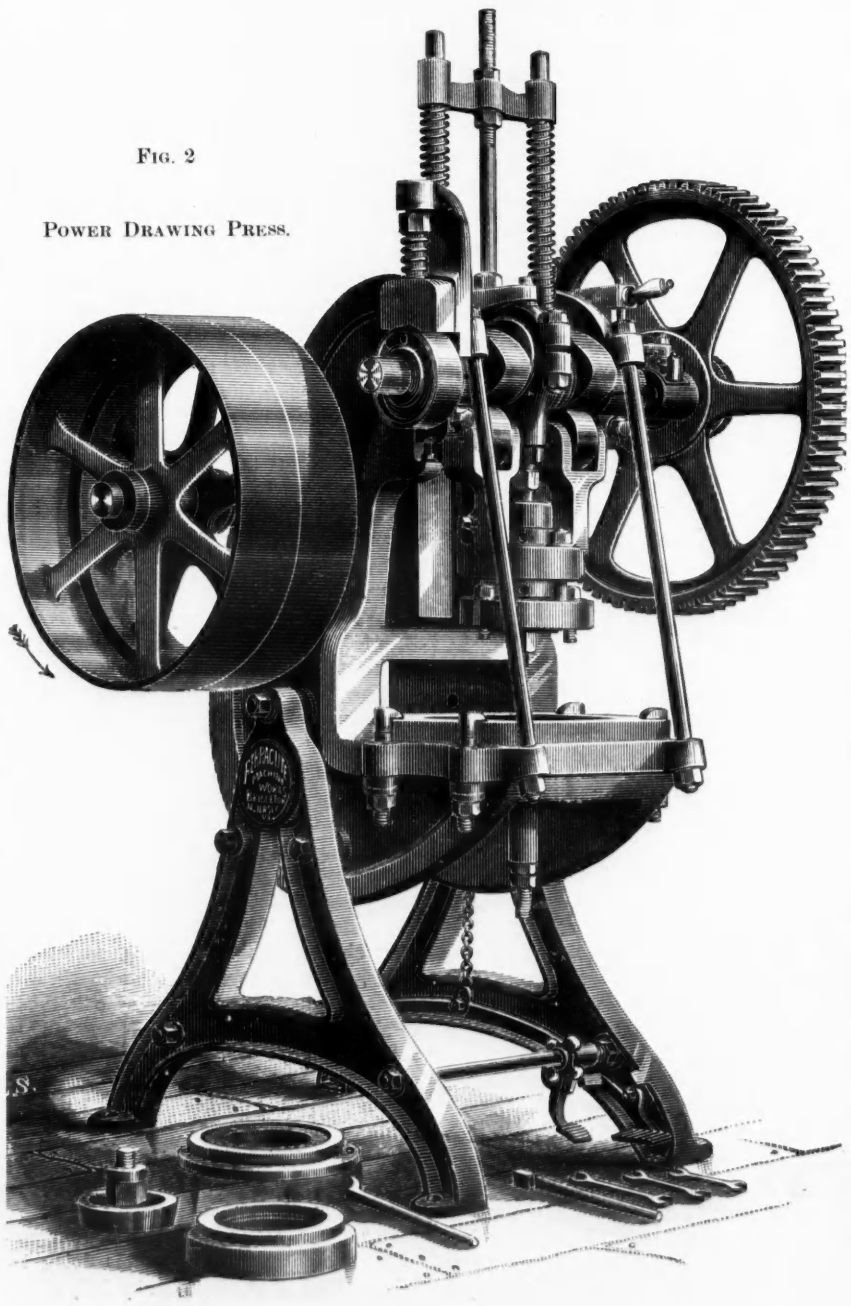


FIG. 1.—FOOT PRESS.

FIG. 2

POWER DRAWING PRESS.



Bits of Experience.

BY PROF. JOHN E. SWEET.

No. VI

The subject of bearings for journals has been pretty well agitated of late in the columns of the AMERICAN MACHINIST, and somewhat more so in the meetings of the Syracuse Mechanical Association, from which some of the facts in the case may be of value in future discussions. An authentic account was given of a loose pulley on a scroll saw (which was itself but little used) running for fully six months without the application of a drop of oil. It had been noticed that it required less attention than loose pulleys in general, and so was oiled and allowed to run until it showed evidence of wanting another supply, which did not occur in over six months. This was nothing but a cast iron pulley on a wrought iron shaft, with nothing but a plain oil hole.

Another case of a successful loose-pulley experience was related, where the pulley was subjected to excessive duty—a plain cast iron pulley with a right and left hand groove, cut from nearly end to end. Still another, of a loose pulley, where the hole had been so badly worn as to call for repair, and to make a short job of it, it was bored out and babbitted. This had to be relined about every two months. If any man has the courage to use a cast iron box in the place where people have been in the habit of

seeing bronze or babbitt metal, he is sure to meet with ridicule, though the loose pulley upon which the belt runs half the time is cast iron, and has but half the length of surface to stand the wear. If the loose pulley gets dry and sticks, they drive it off, file it a little, draw-file it instead of filing it round and round—if they know enough, oil it, put it back, and it goes all right, and they do not profane the loose pulley nor the cast iron hole, nor think of it.

If the babbitted box gets dry or wears out by use, they stop the machine, dig out the old box, fix up and rebabbitt it, spend a half day in getting it going, and do not profane over it either. But let the cast iron box get dry and stick, and one-fourth the time spent in getting it to go that would have been spent with the babbitted box, and there is music in the air directly.

If the cast iron box is solid, is a good job, and not too tight, and is kept oiled, nearly all will admit that it is the best thing out. Then why not invent or adopt some way to keep them oiled, and use the best, instead of beating around?

Small bearings run more easily than large ones, unless the small ones have so little surface that they run metal to metal, in which case, the large bearing will run the easiest, if it is large enough to run on the oil. Then the large one not only runs the easiest, but never wears out.

It is best to get wearing surface by increasing the length, instead of the size, in most cases, up to the point where the bearing is not so long as to spring within itself; beyond that point, the bearing had better be increased, by increasing the diameter. This is especially the case in crank pins and main journals of engines. A short crank pin and turning the crank casting itself wrong side out are among the things that render high speed possible. The excessive strain on these parts of an engine, constantly bending them out of true, is one of the sources of trouble. The speed of the sliding surfaces is slow, compared with that of other journals, which give no trouble. The sliding surfaces of wood planing machine journals run at one thousand feet per minute, or more; and at Cornell we run a shaft at the enormous velocity of sixty thousand revolutions per minute on journals $\frac{3}{16}$" in diameter, which made a sliding friction surface of over one half mile per minute. No crank pins have anything like this velocity, and when they are true there is no reason why they should not stand as high surface velocity as any other journals.

When main bearings and crank pins have to be deluged with water to keep them cool something is wrong, and that something wrong is because they are not large enough, or are untrue, or spring. The longer they are made the worse they will spring, if they are of the overhanging sort. All full cranks, or double cranks, as some call them, never bother from springing, because springing does not throw them out of line; but they give trouble sometimes because they are too small.

It was my misfortune to be compelled to stay at the Centennial Exposition three or four days while the engines were being dismantled; and of all the engines with full cranks I saw but one in which the crank pin was as large as the shaft. While every one who can understand the principles of resistance will at once see that the pin ought to be larger than the shaft, it may be expecting too much to hope for engine builders to see it. But it would seem that if they could be made to discover the fact that the large crank pins never give any trouble and the small ones do, they would at least save the cost of turning them down.

Another thing I noticed in the Centennial dismantling was, that there was but one engine in which the main bearings were not cut up in circular streaks, each having a corresponding groove and ridge in the box. It occurred to me that it must cost a good deal of steam power to grind in the grooves by friction, that they were of no use, in fact, rather costly things to maintain after you get them. A simple remedy is to let the shaft "shuck" endwise, and $\frac{1}{4}$" will do it. It does not hurt the crank pin to let the rod play $\frac{1}{4}$", and nothing will find its own center quicker than a connecting rod. But end play in an engine shaft will not do; it is not mechanical; it is not orthodox; it will *not sell*. Another thing that will not do in an engine is a self-adjusting box. A self-adjusting box for line shafts has, after fifteen or twenty years' growth, been accepted even by some of the men who "have been thirty years in the business." But a self-adjusting box in an engine will not do. If one end of a shaft wears down faster than the other, or if the foundations settle, it seems better to let the boxes wear to fit than to tip into position. Why? I do not know, but it is so.

The first cast-iron bed, slide-rest lathe I ever knew had cast-iron boxes. It has been running ever since; has had as good work done on it as I ever saw done; is good yet, and I doubt if the boxes have been tightened twice in twenty-five years. But cast-iron boxes would not do, and the New England tool builder put in bronze boxes; they sold tip top. The Yankees found they would sell, but were not durable, and they now make bronze boxes and bore the inside out and fill with babbitt metal. The metal does not ruin the shaft, and, by taking up the slack every year or so, it does all right. I know a Bement shaping machine, sixteen or eighteen years old, that has nothing but reamed holes in the cast iron frame, and round wrought iron or steel shafts. It has run pretty constantly, and appears almost as good as new.

I know of but one man who knows anything about cast iron boxes for engine shafts, and he won't tell.

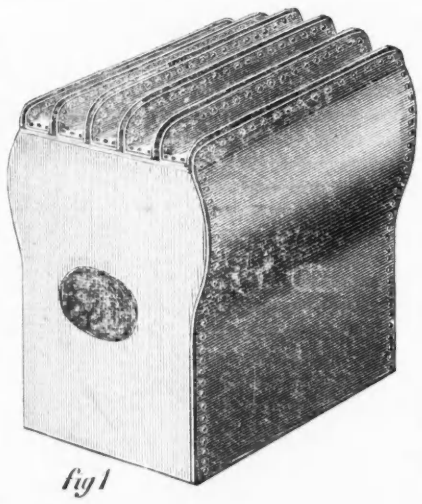
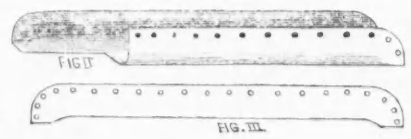


fig 1



Improved Crown-Sheets for Fire-Boxes of Locomotives.

The illustrations show an improvement in crown sheets for fire-boxes, invented by H. S. Bryan, master mechanic of the Chicago & Iowa R. R., Aurora, Ill.

Fig. 1 represents a fire-box complete for the locomotive boiler.

Fig. 2 shows a section of the crown-sheet, a part of which is cut away in order to show more fully the shape of the sheet after being flanged.

Fig. 3 is a plate which is placed between the sections before they are riveted together.

The several sections of the crown-sheet are made of the material usually employed in the construction of fire-boxes, and are substantially U shaped in cross-section, and are placed side by side and riveted together, forming the crown-sheet.

The object of this invention is to dispense with the crown bars, bolts, nuts, washers, etc., usually employed, and thereby obtain a better circulation of water over the crown-sheet, with less liability to mud and scale collecting thereon. All parts of the crown-sheet can be readily washed and kept clean and free from sediment or scale without removing braces, bars, etc., as is necessary in the ordinary construction of crown-sheets with bars attached.

All bolts and nuts projecting into the fire-box from the crown-sheets, as well as the seams in the side sheets, are dispensed with, thereby avoiding a serious objection to the old style of crown sheets with bars. These crown-sheets are very simple and easily constructed, requiring no other extra tools or forms than those to be found in any boiler shop, while the expense of forging and fitting crown-bars, bolts, nuts, washers, etc., is entirely dispensed with. Several of them have been in use for more than two years, under the most severe tests, and have proved to be all that is claimed for them. (*Railway Review.*)

Extracts from Chordal's Letters.

Mr. Editor:

* * * * The most original of workmen, if they don't keep their eyes open and their pluck at command, will sometimes fall into shop ruts, which, if they do no harm in themselves, will, at least, tend to blunt all originality. Railroad shops probably damage a man more in this respect than any other shops. The work of the railroad shop is generally good work, in fact, it is always far superior to marine work in this respect; but it is almost always old repair work, and it is generally one thing after another of the same kind. There gets to be one way of doing a certain job, and, as a consequence, the railroad machinist gets to be a certain kind of a man, and he can always be picked out among men in other shops.

If an original workman has the hardihood to do some job in any peculiar and uncommon way, he is bound to overhear some smart Aleck say: "Well, that's the first time I ever saw that done that way." This remark in most shops becomes a compliment, but in the railroad shop it is always a sneer.

* * * * No machinist in this country has done himself justice until he has worked somewhat in railroad shops, but the lad so unfortunate as to learn his trade in one is to be pitied. No matter how good a workman he is on railroad work, he finds himself decidedly "off" when he gets out in the other shops. He finds he must stick to railroad shops or else grit his teeth and learn his trade over.

* * * * When I say a machinist don't do himself justice until he has worked in railroad shops, I may be accused of intimating that a machinist ought to tramp over the country and work around.

That's just exactly what I mean. A machinist born and bred in one shop isn't worth a cent to himself.

A month or so ago you published an editorial on "Migratory Machinists," in which you pointed out the advantages of sticking to one shop. In this general sentiment I concur; but I hold that there is a time to commence sticking, and that too much sticking before that time tends to damage a man's future.

* * * * Every workman remembers the brief years of his apprenticeship. How new tricks dawned on him and became old, and how jobs were worked around and got out without proper facilities. He learns all of the details of the shop, and gets the run of things generally. He knows the virtues and shortcomings of every tool in the shop; he knows the round, straight lathes, and he knows the flat planers, and he knows all about the drill presses, and knows of every cone pulley which has one step that a belt won't stay on without guiding; he knows what chucks in the shop will fit different lathes, and he knows what chucks will do to bet on; he knows where every odd tap is, and knows when it was made, and what it was made for, and where it can be used to advantage; he knows all about every little special rig and appliance, and he knows all about the methods and customs of the shop, and, above all, in every extremity, in every pinch, and in every desire, he knows what men to go to for aid and comfort.

* * * * During the three or four years of his apprenticeship, the lad is doing two things. He is acquiring skill by daily observation and practice, and he is learning the shop.

When he becomes a journeyman things go on as before. He is still acquiring skill, for no man ever becomes a finished workman. He never stops learning; he is still learning more of the shop; he still has his old stand-by's to lean against in emergencies; he still knows where to find the proper chuck, and the odd tap, and the superior lathe, and the "dingus" to keep that belt on, and the rig to do certain jobs with. His field of skill and observation is limited by this one small shop, or, worse still, by one large shop. The tools he uses are the tools he has seen in this one shop; the tricks and kinks he knows of are the tricks and kinks of this one shop.

This man, born and bred in this shop, is of the utmost value in this shop, but his owners will nine times out of ten expect him to work at low wages, just because he was manufactured on the premises. If the chap has any good stuff in him, he will clear out and look around, and, for that reason, I am a friend of shops which try to gouge workmen who learned their trade there. If these fellows were treated fairly, they would probably stay forever, and that would be the end of them.

* * * * Let the workman stay in his native shop till he dies, and everything would be all right. He should get more pay than he gets elsewhere, and his position being absolutely permanent, he can arrange the affairs of life with some certainty. But the trouble is, his place is never permanent. There is no power having sufficient control of events to guarantee a machinist a steady job, while he is gaining in years, raising his family and adorning his home. As his main value in the native shop depends on his knowledge of that shop, he should try to make himself independent of events, by acquiring that peculiar something, which makes a man a man in every new position.

* * * * How often have I sadly watched some poor unfortunate man of fifty go to work at that late age in his second shop! Twenty-five years in acquiring knowledge too narrow to fit in the new place! He brings nothing but his skill into this new shop. His skill is not much superior to his skill of years ago, and he sees young kids of eighteen around him who belong in this shop, and are, under the present circumstances, his superiors in every respect. He broods in his discouragement and pities the future of these lads, if they do as he has done.

* * * * The trouble with this late move to new fields is, that the awakening comes too late. The disconsolation of an ugly turn in life's affairs at a late age is not very well calculated to fit the average man for the reception of new ideas. It is a bad time, and the circumstances are illy fitted to open up such channels of adaptability as there are in a man. Most men, after one such rude shock to their fancied perfection, become tired, heartsick and discouraged slouches.

* * * * It is a knowledge of the experience and emotions of such men as this, that makes me firm in the belief that a workman does well to begin tramping early, after finishing his time, and to quit tramping soon after beginning. There is no earthly use of keeping the thing up. The idea is to get posted in the general ways of the trade—something which cannot possibly be done in any one shop—and, at the same time, the variety is not so great that its salient points cannot be absorbed in a short time spent in judiciously moving around.

* * * * My advice to a young chap, after serving out his time, is to start out, no matter what pay can be had by staying. Call your starting point your home, and never call it abandoned. Go so far from home that you can't get back, and don't go near any friends or men you have ever seen before. This will put you to the rack of self-reliance, but the thing must come before the boy changes to the man. You will march out into the world, confident that you know all about machine shops. You will get work without much trouble, at least without any of the trouble you ought to be

free from at this turn in life. You will get work where old stagers fail, and you will make friends where the old stager don't look for them. Your first new shop will be a grand revolution.

If you were brought up on twist drills, this shop won't have one in it, and *vice versa*. If you are used to clean, bright, true lathes, you will have to learn to do true work on cranky old machines, which you don't recognize as lathes. If you are used to leaning on friends when "stuck," you will learn to kick for yourself. If you are used to blunt-edged tools, you will be ashamed, and will learn to make tools to cut. If you were brought up on gauges, you will learn the trick of caliper fitting. If you are used to fine work, you will learn another way without forgetting the old. You will learn how to find the odd tap in a strange shop, where men don't befriend you. You will feel like a cat in a strange garret, and will learn how to get over it.

You worked three years on a lathe and call yourself a machinist, and your first job in the new shop will be chipping wide key-seats. You never heard flat work talked about, but here you will be told to make nice planer work fit properly. For the first time in your life, you will see scraping done; you will have to learn how. You were taught to line up engines with a string of some kind, and in this new shop they will kill you if you say "string." You must learn the use of straight edges. You are used to a milling machine, but here they will bring you a lot of bolt heads to chip and file up nicely.

In this new shop you will learn to dress bolt heads and nuts by a hexagon gauge.

Your bolt heads will be hex. but they won't be uniform in width, and they won't be parallel. The next shop you strike will make it warm for you if you dare show a hexagon gauge, and you will learn to do the same work with a square jaw gauge. Here you will make nuts, &c., which will be perfectly uniform across, and will fit a solid wrench as well as they fit your square gauge. You learn to let the angles take care of themselves, and find that if you keep them so they look about right, they will pass for hexagon work and be better than the kind you first learned to fit up.

In your fourth shop, you will be ordered to lap all round work, when you never heard the word lap in your life, and don't know what it means.

You will now become familiar with reamed holes unless you are used to them, in which case you will become familiar with holes finished in the lathe. When at home you had cranes in the shop, but here you will have a chance to study muscle.

You learned your trade with a decent foreman, but now you will learn to put up with a rowdyish blackguard.

You have worked in a shop on your honor, but now you will learn how it feels to be put under rules. These rules will develop meanness in you which you didn't suppose you possessed before.

You have worked in level shops, and now you can learn to work on a floor with forty different heights.

You are used to a coarse shop, may be, where every thing was expected of you, from fitting up engine rods to cleaning out the shop boiler. You will strike a shop which don't allow well paid machinists to do common work.

* * * * In all this tramping for experience, never lose sight of the fact that you are doing it to learn things. Leave friends among men, bosses and people, wherever you go. Never get discharged. Always leave when the shop wants you to stay. Don't be trying to stay, when they want you to go. Never leave any shop under such circumstances that you can't get a cheerful and well wishing good-bye out of shop and office.

Pick out different kinds of shops. Rail road, car, steam engine, locomotive, machine tools, woodworking machinery, mining machinery, agricultural implements, printing machinery, steam pumps, mill machinery, etc. Take in the whole variety in small doses, and then go home and settle down, or move your home to the place you like best.

* * * * Very respectfully,

CHORDAL.

Korting's Improved Steam Blowers.

The accompanying illustrations represent an improved style of steam blowers which have been lately introduced and tested in relation to their efficiency.

The principle which recommends the application of a forced blast through the fire, instead of a strong draught obtained either by a high stack or other means, is to have a separate regulation of the quantity of air supplied to the fire for combustion of the fuel, from that by which the exit of the flames and products of combustion is controlled.

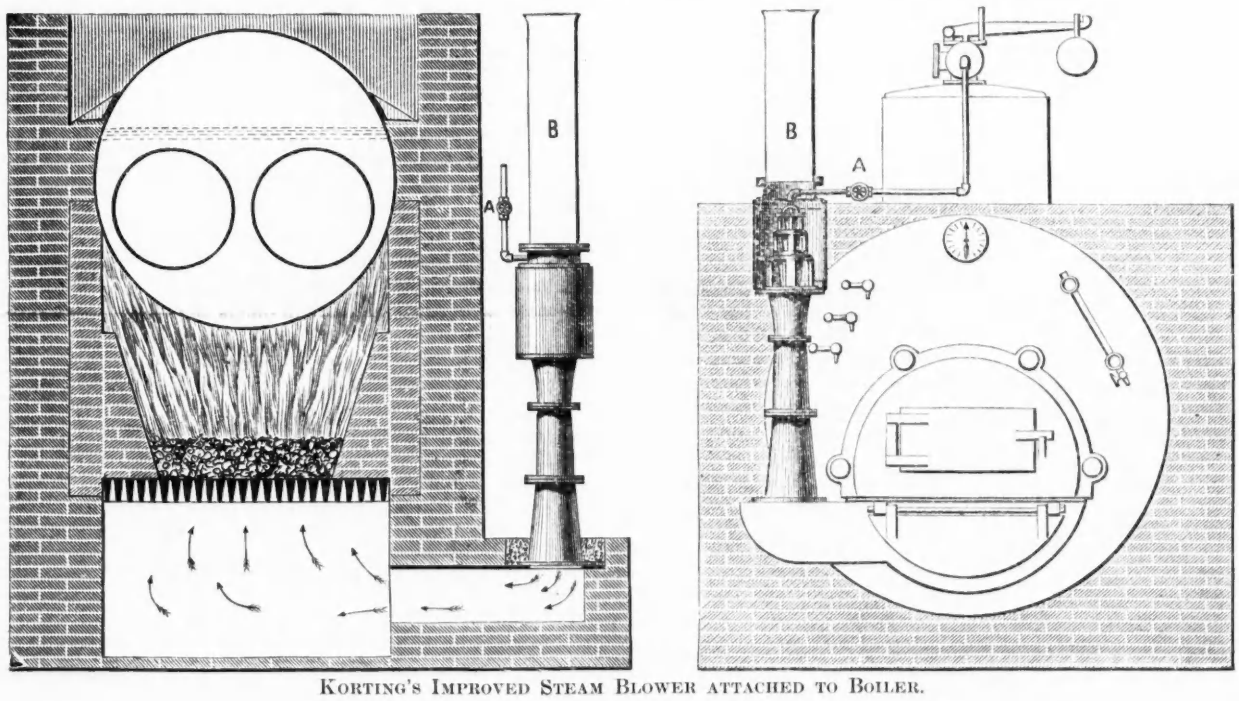
It is well known that by the use of an excessively high stack or other artificial strong draught, nearly double the quantity of coal can be consumed on the same grate than with a draught of ordinay strength—but it is also understood that the more the draught is increased, the less economically is the fuel consumed. The reason of this is that the same force (viz: draught) which supplies the air for combustion by drawing it through the fire, cannot help to rushing the hot gases and flames towards the chimney with a speed corresponding to the force of the draught. This speed is often so great that one-half of the heat which should be used for evaporation or heating is carried up the chimney.

By the use of the furnace blower, it is claimed that this waste is obviated. Firing in this way, the exact quantity of air required for combustion, it is claimed, is forced by the blower from underneath the grates through the fire, the quantity being regulated simply by the increased or decreased opening of the steam valve A. Instead of allowing the flames to rush with great speed up the chimney, their exit is checked by means of the damper, leaving but *sufficient opening* to let the gases escape up the chimney *without having a pressure in the furnace*, and the result is, that a much greater proportion of heat is transmitted to the body to be heated or used for evaporation, if the blower be attached to a boiler furnace.

Besides the advantages resulting from the more economical combustion of the fuel, which applies to any kind of fuel, it is claimed that a much greater advantage results from the use of this blower as supplying a means of using a low priced fuel which could otherwise not be used.

The effect obtained with these blowers, considering the amount of steam used, is greater than that of any other plan to produce the same amount of blast, and the small amount of steam carried into the fire is beneficial to combustion.

These steam blowers are designed for boilers, gas generators, heating furnaces, forges, &c. They are sold by A. Aller, 109 Liberty st., New York; General Agency of Schutte & Goehring's Manufactures.



KORTING'S IMPROVED STEAM BLOWER ATTACHED TO BOILER.

Boiler Proportion and Construction.—Water-Tube Boilers.

BY WILLIAM H. HOFFMAN.

The claim is made by all builders of sectional or water-tube boilers, that their structures are absolutely safe. Is this claim valid? We will see. Nearly every type of water-tube boiler now in use is provided with small sectional compartments for holding the water, but the steam chamber consists of *one* large compartment, generally of sufficient size to be dangerous in case of over-pressure, either by gradual or sudden accumulation. That the latter conditions are liable to be, and are, present at times in this class of boilers, is very evident from the reports of various inspectors that have been published from time to time. These boilers will precipitate sulphate of lime much more rapidly than the fire-tube system, and when the scale reaches a certain thickness, say from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch, it breaks up and leaves the sides of the tubes, falling in bunches at the bottom. The sides of the tubes have, of course, been overheated, and are left in this condition at the instant the scale leaves them. The temperature of the sides of these tubes, *above the second or third* course, is not so high as to repel the water, and it therefore settles on to the overheated tube, and at the point where the temperatures are neutral this water is flashed into steam.

The water tube people say that this does not occur in all the tubes at the same time, but contend that the breaking up of the scale is gradual, that it takes place first in the lower course, then in the second course, and so on, up toward the top sections. I will admit that the scale in the first two or lower sections leaves the sides of the tubes in advance of the courses above them, but I claim that it is quite possible for the scale to leave the tubes in the next two courses in sections large enough to produce a rapid overpressure, and if the steam chamber is weak from any cause, it is just as liable to explosion as the shell of a fire-tube boiler. Therefore, I believe, that before the sectional water-tube boiler can be accepted as a *perfectly safe* generator of steam, it must be a sectional boiler *indeed;* not only as to the water chamber, but in the matter of steam chamber also.

As I just used the words "perfectly safe," I will here recall them. The boiler is not yet designed that is perfectly safe, for even with a sectional steam chamber, an explosion of one or more tubes containing either water or steam is very liable to occur from bad water or management, and to be attended by disastrous results.

I am not "writing down" the water-tube boiler, but hope our friends will try to make them better.

The use of electricity as a motive power for plowing is still being prosecuted in France and at Sermaise, Marne, and lately at Bar-le-Duc, at an agricultural show, Mr C. Felix exhibited his machinery. The plow was one of Howard's double-furrow, and the Gramme drove the drum of the tackle by means of friction-rollers, being itself driven by current supplied from a larger Gramme placed near the steam engine. When the plow has reached the end of the furrow the machine is reversed, and when it is desired to shift the tackle, the friction rollers are detached and the power applied by means of a chain and toothed wheel.

Wooden vessels, which especially in chemical works, are quickly destroyed, should, according to Herr Schaal, be well dried in hot-air, then painted twice or thrice with a solution of paraffin in six parts of petroleum-ether. Vessels in which boiling is effected with steam, should further be coated with linseed-oils varnish, or with water-glass; after drying the water-glass coating should be removed by means of dilute muriatic acid. Paraffin is also well adapted for packing stuffing-boxes, especially in stirring apparatus exposed to vapors of fuming and English sulphuric acid. In alizarine works, Herr Schaal found often as many as 10 per cent. of the workmen, with sore, suppurating, and swollen hands; this was especially bad in winter. The evil almost entirely disappeared after he made the men, before going to work (twice daily) rub their hands with a solution of paraffin in rapeseed-oil and petroleum.

"Did you ever know a man who grew rich by fraud, continue successful through life and leave a fortune at death?" This question was put to a gentleman who had been in business forty years. After reflecting a while he said: "Not one I have seen many men become rich as if by magic and win golden opinions, when some little thing led to an exposure of their fraud, and they have fallen into disgrace and ruin. Arson, perjury, murder and suicide are common crimes with those who make haste to be rich regardless of the means."

Train No. 4 of the Pennsylvania Railroad, consisting of a locomotive and two cars, started from Philadelphia at 12:51 P. M., one day recently, and reached Jersey City at 2:24 P. M., making ninety miles in ninety-three minutes.

The mistake of a stone-cutter, in cutting a figure upside down, made it necessary to transport back to Buffalo from the Lockport cemetery a huge block of granite weighing fifteen tons, in order to have the error corrected.

Boiler Drilling and Turning Machine.

We illustrate herewith a boiler drilling and turning machine, constructed by Messrs. F. & J. Butterfield & Co., of Keightley, Eng. This machine, says *Engineering*, has been specially designed for drilling the shells of boilers, and will admit boilers varying from 6 ft. to 16 ft. diameter, and will drill over a length of 6 ft. 6 in. at once. The machine is constructed on the patented designs of Mr. John Dickenson, marine engineer and boiler maker of Sunderland, and it is suitable for drilling round, oval or square boilers.

The machine consists of two horizontal bedplates A^1 and A^2, made with V slides on top, and placed at right angles to each other. Upon each of the bedplates is fitted a vertical arm B^1 and B^2, each of which carries two saddles C^1 and C^2, these being each adjustable vertically on its respective arm by means of rack and pinion and hand wheels D^1 and D^2. The saddles are balanced so that the least possible exertion is sufficient to adjust them. The vertical arms, B^1 and B^2, are cast each with a round foot by which the arms are attached to the square boxes E^1 and E^2, which are fitted to the V slides on the horizontal beds A^1 and A^2, and are adjustable thereon by means of screw and ratchet motion F^1 and F^2. Each of the square boxes has cast on it a small arm G^1 and G^2, carrying studs upon which run pinions gearing into the circular racks at the foot of the vertical arms. The square boxes have each a circular groove turned in the top to receive the bolts by which the vertical arms are connected to them, and thus the vertical arms, and with them the drill spindles N^1 and N^2, are adjustable radially with the boiler—the adjustment being effected by means of the pinions and circular racks. The pinions are arranged so that they can be worked with the same screw key that is used for the bolts in the circular grooves.

The shell to be drilled is placed upon the circular table H, which is carried by suitable framework adjustable by means of screw on a V slide I, placed at an angle of 45° with the horizontal bedplates. By this arrangement, when the table is moved along I, it will approach to or recede from all the drills equally. J^1 and J^2 are girders forming additional bearings for the framework of the table. The bedplates and slides for the table are bolted and braced together, making the whole machine very firm and rigid. Power is applied to the machine through the cones K^1 and K^2, working the horizontal and vertical shafts L^1 and L^2, etc. On the vertical shafts are fitted coarse pitch worms sliding on feather keys, and carried with the saddles C^1 and C^2, etc. The worms gearing with the worm wheels M^1 and M^2, are fitted on the sleeves of the steel spindles N^1 and N^2. The spindles are fitted with self-acting motions O^1 and O^2, which are easily thrown in and out of gear.

The machine is also used for turning the edge of the flanges which some makers prefer to have on the end plates of marine boilers. The plates are very readily fixed to the circular table H, and the edge of the flange trued up much quicker than by the ordinary means of chipping. When the machine is used for this purpose, the cross beam P, which is removable, is fastened to the two upright brackets R^1 and R^2. The cross beam is cast with V slides at one side for a little more than half its length from one end, and on the opposite side for the same length, but from the opposite end. The V slides are each fitted with a tool box S^1 and S^2, having a screw adjustment for setting the tool to the depth of cut, and adjustable on the V slides of the cross beam to the diameter of the plate to be turned. This arrangement of the machine is also used for cutting out the furnace mouths in the boiler ends. The plate is fastened to the circular table, the center of the hole to be cut out being placed over the center of table; one or both of the tool boxes may be used. There is sufficient space between the upright brackets R^1 and R^2, to allow that section of a boiler end which contains the furnace mouths to revolve while the holes are being cut out; the plate belonging to the end of a boiler of the largest diameter that the machine will take in for drilling. The holes cut out will be from 2 ft. 3 in. diameter and upwards. Power for using the turntable is applied through the cone T. The bevel wheels, worms, worm wheels, and pinions for driving the tables are of cast steel, which is necessary for the rough work of turning the flanges.

As to the practical results of using the machine, the drills are driven at a speed of 340 feet per minute at the cutting edges. A jet of soapsuds plays on each drill from an orifice $\frac{1}{32}$ in. in diameter, and at a pressure of 60 lbs. per square inch. A joint composed of two 1-inch plates, and having holes $1\frac{1}{8}$ in. in diameter, can be drilled in about $2\frac{1}{2}$ minutes, and allowing about half a minute for adjusting the drill, each drill will do about 20 holes per hour. The machine is designed to stand any amount of work that the drills will bear. The time required for putting on the end of a boiler and turning the flange thereon (say 14 ft. diameter), is about $2\frac{1}{2}$ hours; much, however, depends on the state of the flanges, as sometimes they are very rough, while at others very little is necessary to true them up. The time required for putting on the plate containing the furnace mouths and cutting out three holes 2 ft. 6 in. in diameter, the plate being $1\frac{1}{8}$ in. thick, is three hours. Of course, if several boilers of one size are being made at the same time, the holes in two or more of these plates can be cut out at once. The machine is of such design that it can be placed with one of the horizontal bedplates (say A^1), parallel and close up to a wall of the boiler shop; and when the turning apparatus is being used, the vertical arm B^2, can be swiveled half way round on its square box E^2, and used for drilling and tapping the stay holes in marine boiler ends after they are put together; of course sufficient room must be left between bedplate A^2, and the wall of boiler shop parallel with it, to allow for reception of the boiler to be operated upon. Messrs. Butterfield are bringing out apparatus for carrying the boiler during this operation, and which can be used in combination with the shell drill or made into a distinct and separate machine.

Fig. 1.

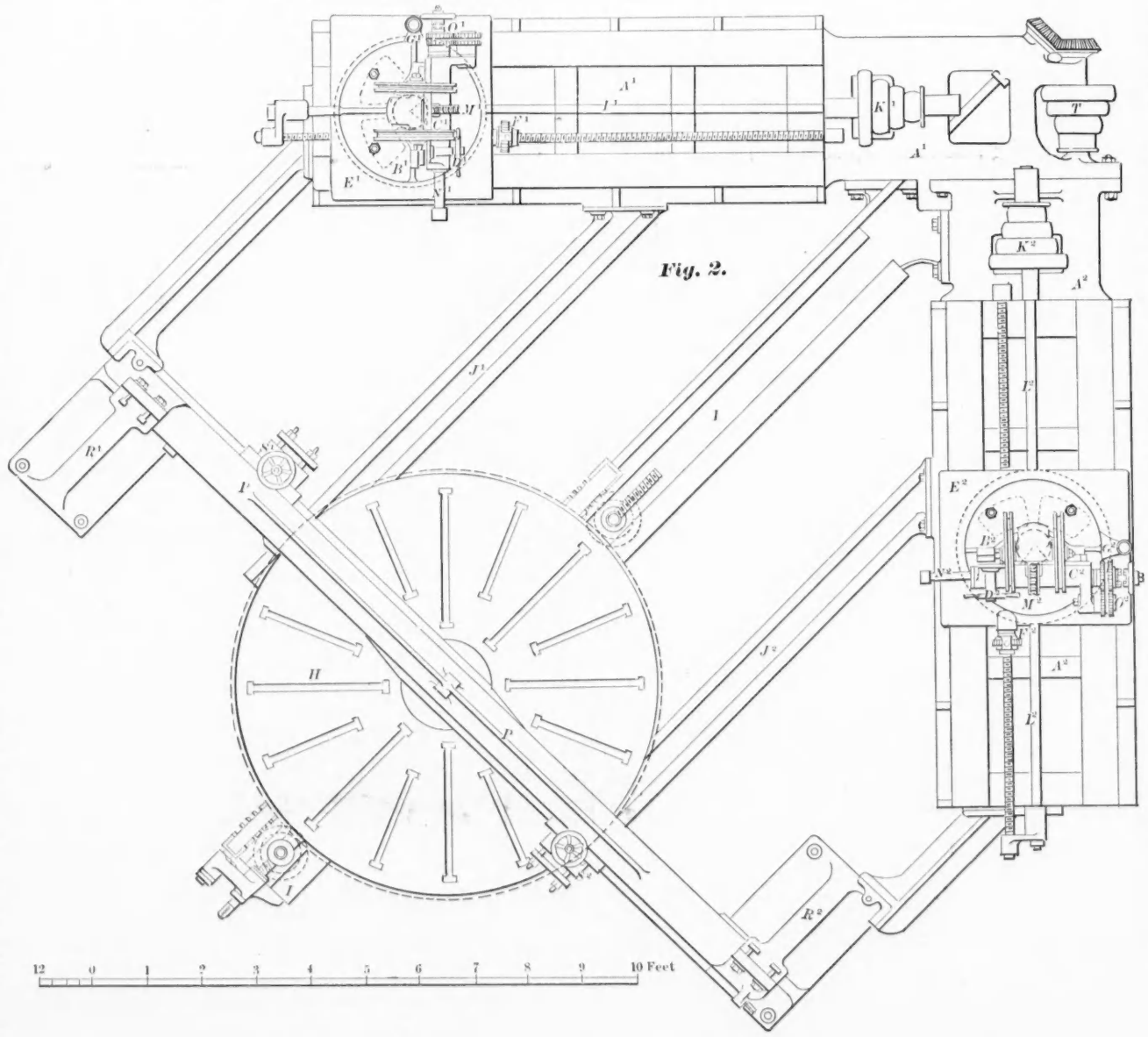


Fig. 2.

Senator Voorhees, of Indiana, in the debate on the River and Harbor bill in Congress, said: "I have never yet heard of a defalcation in the expenditure of money on your harbors or on the improvement of your rivers. Long as I have been in public life, either in the other House or here, I have never heard of an Army officer, an Army engineer, who had charge of public works being suspected of a misuse of the public funds intrusted to his care."

Practical Draughting—What we Know about a Circle.

BY T. P. PEMBERTON.

The most important geometrical figure is a circle. There is much to be said about it. We have selected it as a single illustration for two reasons. First, to show the student how much there is to learn in the study of *one*, apparently, simple figure. Second, to show how necessary it is for a draughtsman to have, at least, *some* knowledge of practical geometry and mensuration.

Note, before you read any further, the numerous objects or parts of objects about you, and *in the distance*, that have an entire, or partially circular form, the outline of which you would represent on paper by a circle or arcs of a circle, as tables, clocks, chairs, brackets, wheels, pulleys, shafts, cylinders, mouldings, arches, wheel-windows, pillars, vases, ornaments, embellishments, etc.; then you will perceive how extensively this figure enters into design, and how it pervades all nature and the arts.

In Nature we nowhere find squares or rectangles; seldom, indeed, right lines. Curved and winding are all her outlines. Although straight lines may be considered beautiful, where they are necessary, yet curved ones are ever more pleasing to the eye. The circle and the ellipse (see conic sections) are a unity in themselves, and yet their boundary is ever varying, thus uniting what have been termed the "essential elements of beauty." A circle is symbolic of eternity, without beginning or ending.

Geometricians define a circle as a plane figure bounded by a curve line, called the circumference, which is everywhere equidistant from a certain point within, called the center. *Circum*, around, is a Latin preposition, used as a prefix in many English words; *fero*, to bear, or carry round, is a Latin verb, hence, we get the words circumference, circumferential, circumferentor. The annexed diagram, Fig. 1, will assist in studying the nomenclature of a circle. *C*, the center; *ICQ*, diameter; *CM*, radius; *AI*, arc; *HLD*, chord; *HLDF*, segment; *AOD*, semicircle; *AOC*, quadrant; *ACM*, sextant; *ICH*, octant; *CMO*, sector; *AMOP*, lune; *HIQD*, zone; *HF*, complement of an arc or angle; *AIHF*, supplement of the same; *HG*, tangent; *LFG*, secant; *ED*, co-tangent; *CRE*, co-secant; *IK*, sine; *HK*, versed sine; *IB*, co-sine.

Two circles having the same center are termed concentric circles; otherwise eccentric circles, as the center of formation and the center of revolution in the eccentric of a steam-engine. The circumference of every circle is supposed to be divided into 360 equal parts, called degrees; and each degree into 60 minutes; each minute into 60 seconds. Hence a semicircle contains 180 degrees, a quadrant 90 degrees, a sextant 60 degrees, and an octant 45 degrees, or, 60″ (seconds) = 1′ (minute); 60′ (minutes) = 1° (degree); 360 ° (degrees) = 1 circle.

The terms in the nomenclature of the circle, and their significance will be more easily remembered, if the meaning of such words as chord, sine, co-sine, supplement and complement is understood, and still better, if the diagram here given, Fig. 1, is repeatedly drawn out on the black board, or with the bows on paper. Reference to any work on practical geometry will be sufficiently explanatory and helpful.

PROPERTIES OF THE CIRCLE.

The circle contains a greater area than any other plane figure bounded by an equal perimeter or outline.

The radius of a circle will go round its circumference six times.

The areas of circles are to each other as the squares of their diameters.

Diameter of a circle × 3.1416 = circumference.

Diameter of a circle × .8862 = side of an equal square.

Diameter of a circle × .7071 = side of an inscribed square.

Diameter² of a circle × .7854 = area of circle.

Circumference of a circle × .2821 = side of an equal square.

Circumference of a circle × .2251 = side of the inscribed square.

Area of a circle × .6366 = side of the inscribed square.

Side of a square × 1.4142 = diameter of its circumscribed circle.

Side of a square × 4.443 = circumference of its circumscribed circle.

Side of a square × 1.128 = diameter of an equal circle.

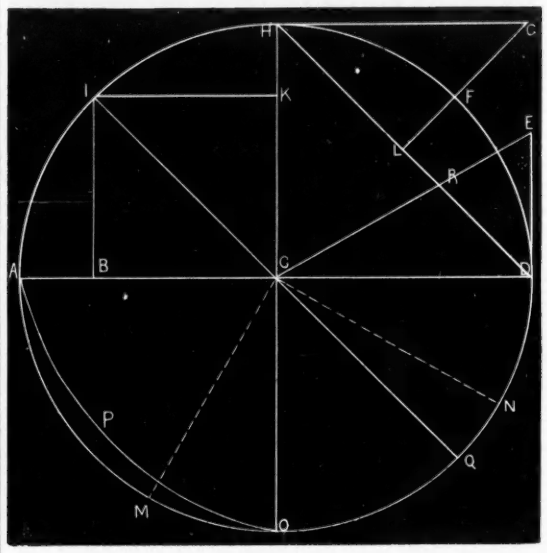


FIG. 1.

Side of a square × 3.545 = circumference of an equal circle.

Radius of a circle × 6.28318 = circumference.

Circumference of a circle ÷ 3.1416 = diameter.

Any circle whose diameter is double that of another contains four times the area of the other.

Area of a circle is equal to the area of a triangle whose base equals the circumference, and perpendicular equals the radius.

The length of an arc may be found by multiplying together the number of degrees it contains, the radius and the number .01745329.

Area of a polygon equals the radius of an inscribed circle × ½ number of sides × length of one side.

A GEOMETRICAL DIVERSION.

Fig. 2 is a circle divided at the twelve points *A*, *B*, etc., by lines, so drawn that they form *C*, a star with 12 points. From the point *A*, draw a line to *F*, from *F* to *L*, to *D*, to *I*, to *B*, to *F*, to *M*, to *E*, to *K*, to *C*, to *H*, and back again to *A*. The problem now to be solved is how to distribute the twelve numbers of the following arithmetical progression, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, into the twelve compartments of the twelve letters which stand at the twelve points of the star, in such a manner that the sum of any two numbers that lie side by side, when added together, shall be equal to the sum of the two numbers which are at the two opposite points of the star. This singular arrangement of the numbers is effected in the following manner:

Place number 2 over the ring which incloses the letter *A*, 4 over *F*, 6 over *L*, 8 over D, 10 over *I*, and so on and the numbers will then be distributed as appears in the cut. Now take any two numbers that lie side by side, and add them together, and their sum will always be equal to the sum of the two numbers found at the opposite points of the star. For example, the sum of the two numbers 14 and 4, which cover the letters *G*, and *F*, is 18, and so also is the sum of the numbers 16 and 2, which are placed over the opposite lettters *M* and *A*. The same is the case with every other pair of numbers and their opposites.

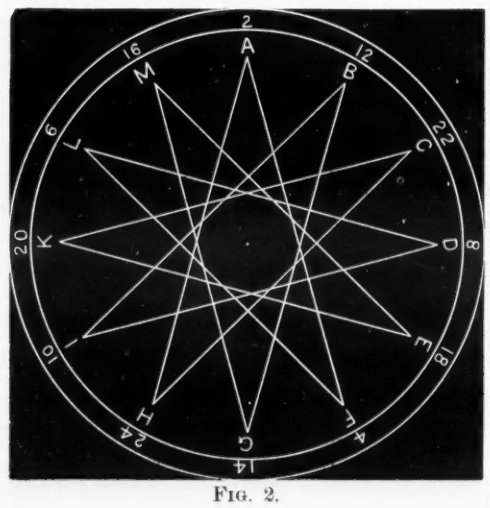


FIG. 2.

The 17,000-pound shaft for the steamer City of Alton, recently cast at the Fulton Iron Works in St. Louis, is now in the lathe being fitted.

Cheap Machinery.

BY EGBERT P. WATSON.

John Jones has a shop to fit out with a new set of tools all through, and like a prudent man, as he is, means to get the most he can for his money. So he writes to various manufacturers, gets their price lists and considers. If he is the average John Jones he immediately contracts for the lowest priced lathes, the planers that weigh heaviest on the price lists, and a 50 H. P. steam engine for about $10 a horse power. When he gets the tools he is delighted at his sagacity and shows them to all his acquaintance, for they look all right, have slide rests of approved pattern, gaps in the bed close to the headstock, so that he can have a bigger pulley than he can swing over the shears, and from a cursory aspect they seem just as good as higher priced articles. Then he begins to use the tools. At first, he is a little exercised in his mind to see that most of the centers appear to have been made with a three-sided center punch, of somewhat greater diameter in one direction than another; that the so called scraped surfaces are blotches made over badly filed surfaces; that the bolts and nuts do not fit each other, that the slide-rest will move back and forth on the screw which feeds it; that the tail stock jams in various places when he moves it up and down the shears, and that when he takes a nut off he can give it a twirl with his fingers, and it comes smiling up in his face. He finds, that the change gears have taper holes of various sizes; some of them fitting very well one side to the spindle, while if turned the other side they won't go on at all. When he bores out a job in his cheap lathe, he finds that it is not possible to get a straight hole; or when he turns a shaft, that the shears wind so that the carriage rocks like a yawl boat in a sea-way. When he notes all these defects he begins to wonder whether he bought a cheap lathe after all; and after he has spent a month in odd jobs, refitting it all over, he thinks that so called cheap machinery is the dearest he can buy.

It is the old story over again of experience dearly paid for. No man that ever worked at a tool himself would think of buying one at about half the price of regular goods, for the simple reason that it is prima-facie evidence that the best, and most essential portion of the work upon them has been omitted.

If John Jones was offered a pair of pantaloons by his tailor at half the price of certain others in stock he would at once understand that it was because the goods were worth less intrinsically, but he has no hesitation in filling his shop with tools that reason and common sense, if consulted, would tell him are only half made.

There is only one class of cheap machinery, and that is made by manufacturers of the longest experience, large capital and a reputation to sustain. Figure for figure, such tools cost more than others; but tool for tool they are cheaper than a cartload of imitations, for they are correct and accurate from the start, while the others are wrong from the start.

A prominent machinist once said to the writer, in speaking of a cheap steam engine he was repairing, that he was at a loss to know how they cut the stud bolts screwed into the boiler, for if he took one out he never could get it back in the place it was taken from. He found similar evidences of peculiar machine work throughout. It is not astonishing that such goods find ready sale because the average purchaser does not know the difference between a good job from a bad one; but the mercantile instinct, which ought to exist in a man who has any object in buying a steam engine, would tell him that where for a given sized cylinder one engine costs two-thirds more than another, there was good reason for it.

"But," says John Jones in defence of his course, "what you say is all very well, but I am not going to pay fancy prices for tools. Dombey & Son make good lathes, but so do Copperfield & Co.; they have got their name up and ask about twice as much as I can buy other lathes for that will answer just as well for my work."

The obvious reply is that a lathe that is not properly made will not answer for any work. Jones says that is not what he means. Put into English, he does not want to pay for fancy work, "high polish and deep scratches." He wants good spindles, good cones, good gears, but no expensive and useless scraped surfaces.

This is a worse statement than the first, for in cheap machinery, what Jones don't want, is precisely the reason he buys it—it catches his eye; and what he does want he does not get, because he won't pay for it. He says accurate workmanship on tools is nothing but fancy work, or mere mechanical sentimentality; but this is where he is wrong, and he will live to find out that in machinery, as in everything else, "the best money can buy is the cheapest."

The company that has been experimenting in Florida with palmetto for paper-making purposes, has met with such gratifying success that they will erect about twenty paper mills in various parts of the State where palmetto trees grow in abundance, and where the transportation facilities are good. Some English paper manufacturers in Canada, have been so influenced by the favorable reports concerning palmetto that they have sent an agent to Florida to ascertain what may be its intrinsic merits.

A women's society for the promotion of silk culture in the United States has been organized in Philadelphia under very favorable auspices. The society has opened industrial schools where the art of growing and reeling silk will be taught.

Philadelphia proposes to put some of its convicts at work cleaning its streets, and expects to make a saving of at least $15,000 per year. The work is to be done at night, and 200 inmates of the House of Correction, with twenty extra guards, are to do it.

An unusual case of deterioration in cast iron gas pipes is reported to have been observed lately at Saarbrueken. The pipes referred to had been laid for ten years, and when removed were found converted into a soft substance which could be cut with a knife, and, on analysis, was found to contain only 52 per cent. of metallic iron. The pipes were laid in channels cut in soft sandstone, filled in with ashes from locomotives, and the coal which produced these ashes was from the Saarbrueken basin, and was relatively rich in sulphur. The destruction of the pipes is believed to have been due to the action of the sulphur contained in the ashes, combined with the oxygen of the atmosphere—this view being supported by the fact that the substance into which the pipes had been changed contained 1⅓ per cent. of sulphuric acid.

Boiler Economy.

BY F. F. HEMENWAY.

The scientific measure of the economy of a boiler is the amount of water evaporated into saturated steam, at some unit of evaporation per pound of combustible. This unit, for convenience of comparison, is usually $965\frac{6}{10}$, or, the units of heat required for the vaporization of one pound of water, under a pressure of one atmosphere. However convenient this may be, it hardly ever expresses the amount of water which would be evaporated if the evaporation were to take place under one atmosphere, instead of being reduced to that condition from some other pressure at which it actually did occur. Neither is it a correct expression of the relative economy of different boilers, and particularly of different types of boilers, unless the evaporation takes place under the same pressure in each instance, and unless the pressure is the one at which the boiler is to be used. Manifestly a boiler designed to economically generate steam under a pressure of twenty atmospheres would not show equal relative economy when working under a pressure of two or three atmospheres, nor would the reduction of the performance of two boilers, working under these pressures respectively to some standard unit, be in any sense a fair criterion by which to determine their relative economy.

The practical measure of the economy of a boiler in any event embraces more than this, it being necessary to take into account two, and sometimes all of the following considerations, viz, the amount of water evaporated into dry steam of the required pressure, the amount of space occupied by the boiler and its appliances, the probable necessity of stopping for repairs, and the cost, in which is properly included the expense of keeping in repair, renewing, &c. As an instance of the application of the foregoing, it would be useless to demonstrate that a boiler three times as large would increase the general economy of the locomotive engine, looked at in the light of the fuel consumed, because the economy in that case consists in getting a large amount of work from a very small boiler. The space occupied and the steam generated take precedence, and must be first considered. On the other hand it would be an example of bad engineering, under ordinary circumstances, to place for permanent stationary purposes an ordinary locomotive boiler, and then by forced draught and unceasing attention get the same amount of work from it as in the case of the locomotive engine. It may thus be readily seen that boiler economy under different conditions is the product of widely different factors. Theoretically, the subject has been widely speculated upon. Practically, however, it is always worth the consideration of the party who pays the coal bill. One pound of good anthracite coal has a combustible efficiency of 15,000 heat units. Hence, if this could all be utilized it would evaporate under a gauge pressure of 75 pounds, and from a temperature of 60°, 13+ pounds of water. The average performance of boilers is hardly if any more than $\frac{1}{2}$ of this. A consideration of what becomes of the unutilized heat is perhaps the best way to determine how to effect a saving. In the first place it is not all wasted. Man cannot change the laws of nature. At the best he can only tack his little endeavors to these laws, and get them carried along as far as possible, and then submit to seeing them dropped. As in the cylinder of an engine the useful effect is limited to a difference of temperature expressed in a few degrees. So in the boiler, the useful effect must be obtained between the temperature of the fire, which may be termed the initial temperature, and that of the escaping gases or the terminal temperature. Fortunately, these extremes—initial and terminal temperatures—may be, and usually are much more widely separated in the case of the boiler than in the cylinder of the engine. Different temperatures in contact seek to equalize themselves. If we take into consideration the inside of the boiler where useful work is being done, and the outside where a contrary condition exists, it is evident that however perfect our appliances for utilizing the heat, the simple fact that we are working for a temperature higher than that which we are working in is proof that the result will not in any event be absolutely perfect. This lack, however, is not a loss, since it is something we never had nor can have.

This consideration of the subject is mainly interesting as indicating the sources of greatest loss, and, hence the direction in which to look for a saving. Assuming, as we have previously done, that one pound of good coal will, under perfect conditions, evaporate 13 pounds of water, how much ought it to do in practice? Ordinarily, and where space has but little to do with the subject, seventy per cent. of that amount or nine pounds. Where the heat from a high pressure engine is available, this amount should be increased to not less than ten pounds. Whenever, then, less then nine pounds of water without a heater, or ten pounds with a heater, are evaporated with one pound of good coal, and under a gauge pressure of 75 pounds, it is safe to assume that better results may be obtained. But if nine pounds ought to be realized and no more (at an average) than 6½ pounds are realized, what has become of the heat represented by this difference? The heat amounts to 28 per cent. of all the fuel burned, or the consumption of forty per cent. more coal than is necessary. It has been lost mainly in radiation from the outside of the boiler or brick work, and passed off with the products of combustion. It represents a total loss, because the possibility of saving it exists. Regarding the first mentioned source of loss—external radiation—the remedy is obvious—more careful attention to outside protection. Regarding the second source, the escape of heat past the heating surfaces of the boiler, more attention may be necessary to make plain the causes of the loss occurring here.

The horse-power of a boiler is, unfortunately, an almost meaningless expression. If we assume it to be the evaporation of 30 lbs. of water at a pressure of 75 lbs. (per gauge), it may be undoubtedly done on the more usual allowance of 15 square feet of properly proportioned heating surface. Assuming that 15 feet may be sufficient, it does not follow that because a certain boiler has 50 times 15 feet of heating surface it is a 50 H.P. boiler, any more more than it does that a definite cylinder capacity makes a certain H. P. engine without reference to piston speed, steam pressure, or, whether the construction is such as to allow a proper use to be made of its capacity. So long as the purchaser is willing to accept a certain number of feet of heating surface as the exponent of a H. P. without reference to its location, so long we shall see multitubular boilers with 30 per cent. more tubes than can by any possible fiction be proved to be of any utility. But they will all be reckoned as effective heating surface just the same. The total amount of heating surface may be all right, but the total amount of *effective* heating surface is all wrong. It has been cut off at the ends and patched on at the sides in defiance of the common-sense fact that it takes time for the heat of combustion to pass through the metal and become absorbed by the water, and that to furnish this time length of run is indispensable.

Again, assuming the 15 feet of heating surface to be ample when the boiler is new and clean in all its parts, we have yet to meet the condition of its becoming old, and its efficiency impaired by the formation of scale. It has been demonstrated that this may result in loss of efficiency anywhere to the extent of 50 per cent., according to the nature and thickness of the deposit. It is useless to say that scale should not be allowed to form in a boiler, because it *does* in spite of all known precautions. This may not always mean the impairment of economy to that extent, but it *may* mean its impairment in even a greater ratio. The presence of scale on the heating surfaces of a boiler does not imply that the heat will not penetrate it, and so become absorbed by the water in contact, but it will not penetrate near so readily as it would the iron alone; hence in effect it has lessened the heating surface, since the effective heating surface should be measured from a consideration of its quantity and quality.

If the economy is to be preserved the work done must be diminished, when by keeping the heat longer in contact with the heating surfaces more time is allowed it in which to pass through them. The reverse of this is what is usually done; that is, the boiler is kept up to its work by forcing a greater quantity of heat and, of course, at an increased velocity, by the heating surfaces, and the result is the escape of a larger percentage into the chimney. But this is not all nor perhaps the worst of it. The heating surface to be effective must have water in contact with it. The pepper box, or as many tubes as you can get in style of construction, has the serious fault of not having sufficient room for the escape of steam and the circulation of water. This defect is aggravated by filling up a portion of the scanty room by a rough, uneven deposit, over and by which the steam and water are further hindered from passing; so that instead of having water (which absorbs heat with remarkable rapidity) at all times in contact with the metal, or at least with the scale with which it is covered, the place of the water is partially occupied by steam which absorbs heat much less readily. Any one who has seen this class of boilers "raise" the water 6" when working over a hot fire, often to such an extent that it becomes absolutely necessary to open the fire door for safety, will have no difficulty in believing that the space which ought to be occupied by water frequently has very little water in it. Thus the efficiency of the boiler has been curtailed by providing a power (slower) conductor of heat, and, at the same time providing a power absorber. If to this condition is added what is almost universally the fact, viz., that the boiler-scarcely large enough when new, has had additional demands made upon it from time to time, we shall see one cause for the low evaporative duty of a great many boilers, and perhaps one serious cause for accidents as well. Since the boiler will be new but once while it will be old as long as it lasts, it should be calculated for good duty when from the causes named it shall become less effective. The result will be increased economy in the consumption of coal in the beginning gradually subsiding to good standard economy, and an increased economy in the way of repairs which will much more than overbalance the increased first cost.

As to the kind of boiler, almost any will give good results which has sufficient run to allow time for the transmission of heat, with water at all times in position to absorb the heat transmitted. Upon general principles, that boiler will show the best results which presents the greatest amount of efficient heating surface, with the least amount of external radiating surface. This statement, however, must only be taken in a general way. A great many patent boilers are devised, evidently with this object in view, but at least nine-tenths of them make better failures than anything else. The locomotive boiler, as used in locomotive practice, is economical only so far as space occupied is concerned, because it is used beyond its normal capacity. The same type of boiler, used for stationary purposes, at a moderate rate of combustion, say from seven to eight pounds of coal per hour on each foot of grate surface, and with the connection with the up-take *below* the tube sheet, gives results hard to beat. Of course, the exposed surface should be thoroughly clothed to prevent radiation. Objection is sometimes made that this boiler requires closer attention as to water than some others, but this is hardly worth considering in the light of an objection. Neither are they particularly liable (as is often asserted) to failure in their fire boxes when properly constructed. With extremely bad water or very poor coal, their use is not commendable. Their first cost is not much more than the return tubular (including brick work) while the cost of maintenance is about the same.

The greater loss of heat in radiation from masonry will generally render the return tubular scarcely as economical as the locomotive boiler, but the greater simplicity of the former will, perhaps, generally overbalance this loss. In extreme cases of bad water, or in out-of-the-way places, in the event of repairs being necessary, the single, or two-flue boiler, or even the plain shell with no flues, will be used; not with the expectation, however, of obtaining high economic results. Wherever, as in the majority of instances, the economy consists in evaporating the greatest amount of water with the least amount of coal, the result will be reached by providing large (long) heating surface, slow combustion, and ample room for the escape of steam and the circulation of water. Undoubtedly, this means increased first cost, and if it cannot be shown to pay, is not worth consideration. Fortunately, the means employed to insure economy in the use of coal are the very means that should be employed to bring about the same result in regard to repairs, safety, and renewing.

By way of comparison, assume a boiler in operation, evaporating seven pounds of water per pound of coal, using 4000 lbs. of coal per day, worth, say, $8. Query: How much could the owner afford to have paid for a boiler which would have evaporated nine pounds of water per pound of coal?

Let the cost of the present boiler be $2,000. Then 9:7::$8.00:$6.22; and $8.00−$6.22=$1.78, the saving per day, or $534 a year. This would represent the interest at ten per cent. on $5,340, which added to $2,000=$7,340, or the amount he could have paid for his boiler and made ten per cent. on the extra investment. In point of fact, he would make from 75 to 100 per cent on the extra sum he would actually invest. It seems unnecessary to pursue the subject further in this light, and yet this is not an extreme statement. On the contrary, it is no more than a fair statement of facts in the case of a large per cent. of boilers in use to-day. It is anything but complimentary to our boasted progress in steam engineering.

The remedy for this is more attention to the matter by the users. Let their attention be turned to determining what their boilers are doing, and how much it is costing to do it, and they will soon come to demand a standard efficiency. We shall hear less of burned sheets and tubes, and the cases of mysterious (?) explosions will be materially lessened. Above all, such monstrosities as boilers rated by heating surface, one-third of which might better be in the chimney, will be things of the past.

Letters from Practical Men.

THOUGHTS ABOUT BELTS.

Editor American Machinist:

Mr. Nystrom's acknowledgment, in No. 22 of THE AMERICAN MACHINIST, is a very strong recommendation for his disposition; and as he seems to favor a little discussion, the desire comes to me to ventilate some thoughts which I have on the belt subject; but in so doing, nothing of a personal nature will be indulged in—any names mentioned will be only for purposes of designation. Holding, as I do, that fair, open controversy is the only way in which "mechanical confusion" may be avoided, I shall write just as I think, and shall alter my views just as soon as necessary evidence brings light to my mind.

Disregarding the pocket-book, and considering the formula that Mr. Nystrom presents in No. 22, I should say that a belt $45\frac{96}{100}$" wide, on a pulley 36" diameter, at 80 revolutions per minute, was doing very heavy work at 75 horse-power, when the speed is taken into account; 50 horse-power would be a fair load for economical endurance. But why employ such extremely low speed?

Now, "Economics" is the science which teaches how to manage to the best advantage. To say the least, it would be doubtful management to use a belt 47 inches wide, costing $9 per foot, a pulley 36×48, costing $75, and a shaft 5 inches diameter, costing $5 per foot, with 75 H.P. to be transmitted. Mr. Nystrom does not say that we must use belts of such proportions; but the question,

"Why put such impracticable examples in books of instruction?" is a very pertinent one in the premises; a few such are apt to mislead a hurried investigator.

A pulley 48×17, costing $37, on a shaft, 3¼ inches diameter, costing $1.75 per foot, and making 250 revolution per minute, with a belt 16 inches wide, costing $2.50 per foot, would transmit the same power; the additional speed costing nothing, as the following calculation will exhibit. The friction of shaft bearings under good conditions depends upon the pressure. The H.P. necessary to overcome friction depends on the frictional resistance, multiplied by the feet traveled per minute by the surface of the shaft in contact with the bearing. Therefore, in the case of slow belt speed, the large shaft and pulley, and the wide belt, we have greater power absorbed by friction than in the second case.

Assuming that we have a bearing each side of the pulley, and a distance between the centers of the two lines of shafting of 30 feet, we have the following exhibit: Weight of, say, 6 ft. 5 inch shaft, 400 lbs.; weight of pulley, 36×48, 1,000 lbs.; weight of 70 feet of 46-inch double leather belting, 400 lbs.

Large belts, depending upon their weight alone for driving force, exert a pressure on the shafting they connect, equal to about three times the weight of the belt. This conclusion is reached by means of experiments with different depths of "catenary curves," the shallower the curve the greater the strain.

When a belt is running, the curve at the "slack" side deepens, while the curve at the "pulling" side approaches nearer to a straight line. Even allowing that the above ratio does not hold in all cases, it will be sufficiently accurate for a comparison; there being no square root in the matter, the proportion will be preserved. Therefore, the pressure exerted on the bearings by the belt, would be 1,200 lbs.; one-half, or 600 lbs., on each shaft; and adding weights of shaft and pulley, we have a pressure of 2,000 lbs. on two bearings.

In the second case, 6 ft. of 3¼-inch shafting, 168 lbs.; weight of pulley, 48×17, 350 lbs., 73 ft. of 16-inch double leather belting, 160 lbs.—the weight of belt treated as before, gives 240 lbs. for each shaft; summing up, we have 758 lbs. pressure on two bearings. The five-inch shaft, at 80 revolutions, gives a surface speed of 104 feet per minute. A 3¼-inch shaft, at 250 revolutions, gives a surface speed of 212 feet per minute.

To compare the two cases, we have only to assume that in No. 1, X = H.P. absorbed in driving shaft; then in No. 2, as the factor of force is reduced 63 per cent., if the speed remained the same as in No 1, the H.P. would be reduced in like ratio. But as the surface speed in No. 1 is only 49 per cent. of that in No. 2, it follows that the net reduction in H.P. absorbed would be only 30 per cent. But we still have something to be thankful for; the energy expended in friction is reduced 30 per cent., and the cost of this portion of the plant is reduced about 70 per cent.

Before bidding farewell to the "pocket books," I would mention, that in a certain one may be found the statement that the width of a belt is independent of the driving force; in other words, a narrow belt will drive as strongly as a wide one, if it (the narrow one) is strong enough to hold together. In No. 22 of the AMERICAN MACHINIST, Mr. Rose intimates that he holds the same view of the matter. Now, as I understand the statements, I do not believe any such thing. Weight in a belt adds force; increase in width increases weight; therefore, I hold that it is impossible to drive as great a power with a narrow belt as with a wide one, diameter of pulley remaining the same. Pratt & Whitney may as well leave off one of the belts from their drop hammers, or they might reduce the width of the remaining one, if width is of no advantage. A good leather belt, if well put together, will slip around a pulley before it will part, and only receives damage from the slipping contact, and not from the strain which causes it to slip.

The increase of friction by increasing the surface, may be illustrated by Mr. Rose's favorite surface plate. If he maintains the same thickness, he cannot increase the surface without increasing the weight, and as friction depends on weight alone in such a case, the friction increases. Assuming that X=friction per square inch, then the total friction would be X times the number of square inches; for 100 square inches friction would be 100 x; for 200 square inches, 200 x, etc. To say that a wide belt will not drive more than a narrow one, is to assert that two belts will not drive more than one.

Respectfully yours,

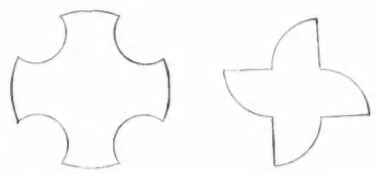
CHAS. A. HAGUE.

Chicago, May 31, 1880.

CONCERNING TAPS.

Editor American Machinist:

If you drill a hole to be tapped so that it is slightly larger than the bottom of the thread, some taps will cut a thread that is larger than the tap itself: that is to say the tap will shake sidewise in the thread it has just cut. It seems to me that this is a defect, and that it is due to the way in which the tap is fluted. It is a mooted question among mechanics what the best form of fluting is. My own view is that what will answer for



No. 1.

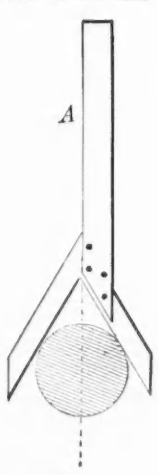
No. 2.

a large tap will not answer for a small one. By large I mean one inch and over, by small one fourth of an inch and under. Some firms, I notice, flute taps like sketch No. 1, while others flute them as in No. 2. Which is the best I do not pretend to say.

Perhaps it is not generally known that it makes a perceptible difference in tapping a hole what size it is drilled. If for only half a thread but few taps will cut their own diameters; they cut larger. A tap of given size will cut a larger tapped hole in cast iron than in wrought iron, both holes being drilled same size.

E. P. WATSON.

Stockbridge, Mass.



LINING UP SHAFTS.

Editor American Machinist:

"J. L B" asks for information as to the best method of setting a shaft in line with one already located, and to be connected with it by flange couplings. I have often been deterred from offering practical information to correspondents of THE AMERICAN MACHINIST and other papers, because of the "best methods" being called for; and while I have some very good and practical methods for accomplishing various things, I am not so sure that I have adopted the very best for any purpose.

I have had to deal with "J. L. B.'s" stated problem frequently, and am quite sure that the method described by you is a very successful one, when there are no interfering conditions. Assuming that the axial line for the new shaft is always a line passing through the centers of the journals of location shaft, my method is this: I prepare two pieces of boards (I will call them templets for want of a better name), a little wider than the diameter of the two extreme journals of the shaft in place, and about 2 or 2½ feet long. Through the centers of each templet I draw a fine line with pencil or gage, and placing the compasses in these lines, near one end of each, I describe and carefully cut out half circles equal to the diameters of the journals. Leaving enough material to keep these half circles intact, I cut away one side of each of these templets to the center line. Next I place one of these pieces perpendicularly in one extreme journal as determined by an accurate spirit plumb, and place the other on the other extreme journal to agree in perpendicularity with the first, as determined by the divine art of "squinting," after the manner of the carpenter with his "bats" in taking large timbers "out of wind." When these templets are in place by "sighting," as the compass surveyor ranges along the sights of his instrument, a point may readily be located at or beyond the extremity of the shaft to be put in place, which shall be in a vertical plane, cutting through centers of the located shaft. From such point a line may be stretched back to center of shaft at point of coupling, by which bearings may be properly set by means of the half circular templets generally used in lining journal boxes.

This method is practical under all possible conditions; its success depending on the care with which each step in the operation is taken. So frequently have I had to accomplish what "J. L. B." wishes to arrive at, that I have prepared two V shaped pieces of metal, attached to the ends of two rules in such a way, that when these V's are set upon the journals one side of each of the rules will be a radial line from center of the journals upon which placed. The advantage of these instruments is that they may be employed on all sizes of shafts whose journals are truly cylindrical, and, being once accurately adjusted, are more perfect for the purpose than temporary fixtures are likely to be. I have made a sketch of my device, which I send herewith. By placing one of the sights illustrated upon each of the two journals of a shaft, and ranging along the edges A, the true center may be projected to any distance desired within the limit of vision.

A. FORREST.

Dubuque, Iowa.

There are at the present time in Germany 329 beet sugar mills, which produced in 1878 a total of 850,000,000 pounds of sugar. The total annual product of beet sugar in Europe is about 3,000 000 pounds. It requires on an average twelve pounds of beets to make one pound of sugar It was Marggraf an apothecary, of Berlin, who first (in 1747) pointed out the value of the beet as a source of sugar, but the credit of having developed the industry belongs to the French. Napoleon the First and his celebrated Minister, Chaptal, afforded great encouragement to the cultivation of beet root After the fall of Napoleon it languished for a time, but was subsequently revived on a surer basis and with greater success, until at the present day the beet not only rivals the cane in the markets of the world, but threatens its existence as an economic source of sugar.

Holyoke Turbine Tests.

In our last issue we presented the figures of the test of a Hercules Turbine Water Wheel made at Holyoke, Mass., by James Emerson and Samuel Webber. We give below the test tables of seven other turbines as determined by the same gentlemen, and regret that the limits of our space will not admit of giving cuts and descriptions of them. The New American turbine made by Stout, Mills and Temple, Dayton, O., was tested October 14th, 1879; the Monarch made by some one in North Carolina, November 15th; the Tyler made by Fitchburgh Machine Co., Oct. 9th; the Thompson, October 11th; the Wetmore made by Sullivan Machine Co., Claremont, N. H., November 14th; the Sherwood made at De Moines, Iowa, October 18th.

"NEW AMERICAN" TURBINE AT HOLYOKE FLUME. Wheel 5 feet diam., with Bucket of "Swain" form, in "American" case Weir 12 feet long. Friction pulley 20 feet in circumference.

No.	Load in pounds.	Rev. per Min.	Head in feet.	Weir in feet.	Cu. feet Water per Min.	H. P. Wheel.	H. P. Water.	Per centage of Net Effect.
1	2000	110.5	16.32	1.819	5619.91	133.94	173.55	.7717
2	2050	108.3	16.32	1.819	5619.91	134.58	173.55	.7755
3	2100	104.66	16.27	1.827	5656.75	133.20	173.54	.7662
4	2050	106.5	16.30	1.815	5601.49	132.32	172.51	.7670
5	2025	109	16.32	1.807	5564.72	133.77	171.34	.7791
6	2075	105.5	16.31	1.808	5569.31	132.04	171.58	.7695
7	2050	107	16.38	1.789	5482.26	132.94	169.52	.7842
8	2025	108	16.38	1.782	5450.28	132.34	168.63	.7860
9	2075	106.25	16.39	1.790	5486.83	133.62	168.	.7953
10	2000	108	16.40	1.743	5273.19	130.91	164.26	.7969
11	2025	106.25	19.53	1.740	5259.65	130.68	165.13	.7914
12	1975	109	16.63	1.756	5332.03	130.47	167.49	.7790
13	1900	109	16.69	1.667	4933.21	125.51	155.55	.8068
14	1800	106	16.88	1.578	4545.89	115.64	144.9	.8000
15	1700	111.75	16.90	1.564	4485.24	115.14	143.05	.8049
16	1750	108.6	16.89	1.571	4513.68	115.25	144	.8000
17	1775	107	16.87	1.575	4530.94	115.11	144.38	.7973
18	1500	109	17.16	1.441	3993.98	97.58	128.49	.7594
19	1525	108	17.16	1.440	3959.84	99.81	128.32	.7778
20	1475	107	17.12	1.435	3939.14	95.65	127.75	.7487
21	1175	111.3	17.44	1.284	3329.95	79.4	109.69	.7239
22	1300	109.3	17.44	1.287	3341.74	79.51	110.08	.7223
23	1100	106.3	17.60	1.191	2970.69	70.73	98.76	.7168
24	1000	103.3	17.66	1.151	2820.09	62.63	94.01	.6662
25	975	106	17.68	1.150	2846.27	62.64	95.05	.6590
26	900	112.5	17.69	1.143	2790.26	61.36	93.24	.6581

MONARCH TURBINE 12 in diam., 6 ft. Weir. 10 feet circumference of Friction pulley.

1	75	265.5	18.49	.618	418.19	6.03	14.60	.4130
2	85	250	18.49	.620	423.66	6.44	14.86	.4352
3	100	235.67	18.49	.623	427.76	7.14	14.94	.4779
4	110	223	18.51	.624	429.14	7.43	15.	.4952
5	120	207.5	18.51	.624	429.14	7.54	15.	.5025
6	130	192	18.51	.624	429.14	7.56	15.	.5039
7	140	182	18.51	.625	430.50	7.72	15.05	.5129
8	150	166	18.51	.627	433.24	7.55	15.15	.4984
9	130	190.5	18.50	.625	430.50	7.86	15.04	.5225
10	135	187	18.51	.625	430.50	7.65	15.05	.5082
11	135	198.5	18.53	.616	418.19	8.12	14.64	.5548
12	140	186.5	18.53	.614	415.47	7.91	14.53	.5442
13	130	194.5	18.55	.590	383.11	7.66	13 42	.5706
14	140	179.5	18.56	.585	376 44	7.62	13 14	.5806
15	95	184	18.65	.520	292.24	5.30	10.30	.5148
16	75	152.66	18.67	.480	242.80	3.47	8.56	.4053

5 feet TYLER WHEEL. Weir 12 feet long. Friction pulley 20 feet circumference.

1	1950	102.5	16.94	1.634	4739.45	121.14	150.61	.8043
2	2000	100	16.92	1.635	4743.84	121.21	151.61	.8000
3	2050	97.4	16.92	1.637	4752.7	121.01	152 2	.7951
4	2000	98.6	16.82	1.642	4774.64	119.51	151 70	.7878
5	1900	106	16.87	1.653	4823.05	122.18	152.60	.8002
6	1700	100.75	17.17	1.500	4162.55	103.8	135	.7689
7	1500	105	17.28	1.432	3878.55	95.45	126.6	.7539
8	1550	102	17.28	1.436	3895.07	95.82	127.13	.7537
9	1200	99.16	17.62	1.248	3141.21	72.12	103.82	.6947
10	1150	100.5	17.66	1.229	3067.73	70.05	102.53	.6832
11	1100	104	17.81	1.221	3036.98	69 33	102 17	.6786
12	950	96.5	17.92	1.104	2598	55.56	87 93	.6319
13	850	102	17.92	1.086	2545	52.55	85.73	.6129

THOMPSON WHEEL 44 in. diam., 12 feet Weir, 20 feet circumference of Friction pulley.

1	1075	120	17.49	1.319	3330.38	78.18	110.025	.7106
2	1100	119.25	17.48	1.321	3338.31	79.3	109 62	.7234
3	1125	117.50	17.50	1.322	3342.3	80.11	110 48	.7251
4	1100	112	17.47	1.268	3129 27	74.67	103.85	.7180
5	1050	119	17.50	1.269	3133 18	75.42	103.92	.7258
6	950	117.5	17.41	1.181	2794.82	67 65	93 49	.7236
7	800	119	17.51	1.070	2384.6	57.70	80.67	.7152
8	675	117.5	17.95	.958	1930.47	48.07	67.49	.7123
9	500	118.5	18.47	.824	1544.95	35.91	53.02	.6771
10	475	122.66	18.33	.823	1541.76	35.31	53.38	.6614

27 in. WETMORE WHEEL, 12 feet Weir, 15 feet circumference of Friction pulley.

1	350	250	18.38	.775	1505.09	39.77	52.25	.7611
2	375	237	18.38	.776	1508.19	40.40	52.36	.7716
3	400	224	18.38	.775	1505.09	40.73	52.24	.7795
4	425	210.5	18.38	.775	1505.09	40.67	52.24	.7783
5	450	196	18.38	.774	1502	40.09	52.15	.7688
6	390	227.5	18.39	.774	1502	40.33	52.17	.7730
7	400	217	18.38	.775	1505.09	39.45	52.04	.7580
8	400	195	18.43	.750	1367.64	35.45	47.61	.7446
9	350	223.25	18.44	.728	1361.62	35.52	47.43	.7491
10	300	199	18.20	.654	1144.66	27.25	39.35	.6922
11	275	216	18 21	.672	1138.96	27	39.18	.6.92
12	260	223.5	18 21	.6.2	1138.96	26.41	39.18	.6741
13	300	204	18.39	.572	917.75	18.75	31.88	.5819
14	175	225	18.39	.572	917.75	17 90	31 88	.5615
15	150	200	18.53	.512	761 3	15 74	26.65	.5 60
16	125	222	18.53	.512	761.3	12.61	26.65	.4732

20 in. "SHERWOOD" WHEEL. 6 feet Weir, 15 feet circumference Friction pulley.

1	260	248	18.31	.892	882.02	19.54	30.50	.6406
2	270	242	18.31	.895	885.36	19.80	30.98	.6391
3	280	227.5	18.32	.895	895.36	19.90	30.98	.6423
4	250	259	18.31	.895	895.36	19.62	30.96	.6337
5	255	212	18.41	.831	793.48	16.38	27.58	.5939
6	245	243	18.42	.836	801.31	18.04	27.89	.6469
7	225	255	18.43	.847	818.61	17.38	28.50	.6099

40 in. HOUSTON WHEEL. 12 feet Weir, 15 feet circumference of Friction pulley.

1	1050	143.67	16.56	1.116	2697.24	68.57	84.37	.8127
2	1075	140	16.57	1.118	2704.6	68.39	84.65	.8079
3	1 00	137	16.56	1.116	2697.24	68.50	84.37	.8119
4	1125	133.5	16.56	1.118	2704.6	68.27	84.60	.8070
5	1025	146.75	16.64	1.112	2682.52	68.34	84.31	.8105
6	925	144.5	16.59	1.068	2582.32	60.75	79.04	.7686
7	800	143	16.88	1.019	2315.85	52	73.84	.7042
8	790	141	16.70	1.004	2294.8	50.63	72.22	.7011
9	770	145	16.68	1.001	2284.3	50.75	71 97	.7052
10	895	146	16.53	.977	2200.82	46.12	68.97	.6687
11	675	147.5	16.53	.978	2204.28	43.72	68.82	.6352
12	650	149.5	16.57	.970	2176.65	44.17	68.13	.6484
13	850	117.25	17.08	.962	2149.13	45.30	69.12	.6550
14	800	124	16.65	.962	2149.13	45.09	67.58	.6672
15	700	138.5	16.62	.961	2145.3	44.07	67.36	.6542
16	625	140.5	17.02	.941	2077.41	39.91	66.79	.5976
17	600	142	16.56	.932	2046.84	38.73	64.10	.6042
18	575	144.5	16.34	.927	2030	37.77	63.42	.5955
19	450	142	16.94	.864	1820.95	29.04	58.27	.4984
20	425	145.5	16.97	.860	1807.91	28.11	57.95	.4851
21	250	133.5	17.01	.744	1442.68	15.17	46.35	.3273
22	200	144	17.08	.744	1442.68	13.09	46.55	.2812
23	150	145	17.25	.712	1316.86	9.88	42.91	.2302

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.

JACKSON BAILEY, Vice-Prest.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

The American News Company,

Publishers' Agents, New York.

The International News Company,

(Formerly the Willmer & Rogers News Co.)

11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.

Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

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NEW YORK, JULY 3, 1880.

CONTENTS.

	PAGE.
Presses for Working Sheet Metals	1
Bits of Experience.—Prof. John E. Sweet	1
Improved Crown-Sheets for Fire-Boxes of Locomotives	2
Extracts from Chordal's Letters	2
Korting's Improved Steam Blowers	3
Boiler Proportion and Construction—Water Tube Boilers.—William H. Hoffman	3
Manufacturers' and Mechanics' Institute	3
Boiler Drilling and Turning Machine	4
Practical Draughting.—T. P. Pemberton	5
Cheap Machinery.—Egbert P. Watson	5
Boiler Economy.—F. F. Hemenway	6
Letters from Practical Men	6
Our Progress	8
Census of Power and Manufactures	8
Summer Classes in Engineering	8
Industrial Common School Education	8
The Master Car Builders' Convention	9
Questions and Answers	9
Manufactures	10
Machinists' and Engineers' Supplies	10
Iron Review	10
Metal Review	10

Our Progress.

The last issue of the AMERICAN MACHINIST was the 52nd of the weekly series, and this number therefore marks the beginning of our second year as a weekly publication. While we point with just pride to the position and influence attained by the AMERICAN MACHINIST during the comparatively short period of its existence we need not indulge in self-commendation. A journal after being well established will take rank according to its real value, and efforts to build up a fictitious reputation will inevitably result in disappointment. In calling attention to our remarkable progress as an industrial journal we desire to extend our thanks to one and all of our numerous contemporaries who have so generously accorded us special complimentary notices. It is a source of peculiar gratification to us to merit such hearty expressions of approval from our brethren of the press.

Our mailing list embraces subscribers in every state and territory of the Union, also India, Australia, New Zealand, Brazil, Mexico, West Indies, Russia, Belgium, Holland, Switzerland, Italy, Turkey, Germany, Spain, England, Scotland and the British North American Provinces. The paper is also regularly sold on the news stands throughout the United States and Canada, and is constantly gaining in circulation. It is now everywhere recognized as the leading authority upon subjects within the scope of mechanical engineering. Its articles are widely copied not only throughout our country but largely in Europe. Its independent course as well as the original and progressive character of its contents has attracted to its columns the best efforts of many of the ablest and most favorably known mechanical authorities of the times, many of whom write for no other mechanical publication. We shall spare no pains or expense to make the AMERICAN MACHINIST even more valuable in the future than in the past.

Census of Power and Manufactures.

The census which is now in progress differs in many respects from its predecessors. In no particular is this more marked than in the statistics which are asked for in the line of the power and machinery used in manufactures, and the details of the processes. This branch has been entrusted to Professor W. P. Trowbridge, of Columbia School of Mines, and three special agents under his direction have been visiting our largest manufacturing towns gathering statistics during all of last winter and spring. Beside the simple enumeration of machines, some effort is made to ascertain the cost of the power used, whether water or steam, and the amount required in the different industries. Questions are also asked upon the cost of the raw materials, in order to get at the cost of labor in the finished product. In addition to these simple tabular statistics, these special agents gather facts in reference to the processes of manufacture, and the operation of the machines. These are to be embodied in the form of reports in the summaries of this part of the census. These reports will serve in the future as landmarks to note the changes in our processes in the ensuing decades.

Another feature of this department of the census of especial interest to many readers of the AMERICAN MACHINIST is the work upon machine tools. It is intended to embody in the census, a report on the metal and wood-working shop tools of the present day, giving their especial mechanical and economic features, which have made our tools the standards almost for the world. It is also proposed to note incidentally the effect of our high-grade machine tools upon the quantity and quality of manufactured products which results directly or indirectly from them.

This branch of the census will be of great value and interest if the plans of the office are fully carried out. The collection of the facts and the report upon them has been assigned to Mr. F. R. Hutton, Instructor in Mechanical Engineering at Columbia College. Visits will be paid to our leading specialists in these lines and their co-operation solicited. The novelty of this feature of the census may strike unpleasantly at first, but it will be obvious that full dissemination of our claims to excellence in shop tools is a commercial as well as an engineering policy.

As we understand the character of the work intrusted to Prof. Trowbridge and his assistants, it is not to enumerate and classify in a complete manner the various establishments employing power, but to obtain reliable data regarding machinery and processes, cost of power and labor used in manufacturing, and the progress that is being made.

Summer Classes in Engineering.

One of the chief objects aimed at by the instructors in the engineering schools of the present day is to give the students as much practical knowledge as possible in connection with their regular and limited course of study. To attain this desirable advantage many experiments have been made. We have now reached a period when iron is rapidly taking the place of wood, not only for braces and frames for machinery, but the buildings in which the machinery is to be placed are frequently made entirely of iron. Iron is also being introduced as the best material for making the frames of marine beam engines, and for thousands of other purposes, wood is being supplanted by iron. Bessemer steel, it is said, can be produced by the direct process at less cost than iron, which marks an important era of progress.

We had the pleasure recently of visiting the Quintard Iron Works, also the Morgan Iron Works in this city, and examined certain plans for instruction as adopted by Professor F. R. Hutton, instructor in mechanical engineering in the School of Mines, Columbia College, in this city. In the year 1878 an experimental summer class was organized with no special indication that it would prove a success. The effort was in fact scouted by some, and the class thus organized was composed of very few persons. The class was organized from volunteers at the close of the regular term. It spent a few weeks in visiting different shops and taking notes. The class was accompanied by Prof. Hutton, who gave personal instructions to each student, and the experience developed into something of recognized value. When the result of these experiments became known there was a deep interest manifested on the part of the students, which has had the effect of adding to the numbers of the summer class, until at present there are twenty students enrolled as members. The outlines of the plans adopted by Prof. Hutton are as follows: The students are divided into two classes, ten being sent to the Quintard Iron Works, and ten to the Morgan Iron Works, the two divisions alternating. As a preparatory process each student is required to furnish himself with a suit of blue overalls and a shirt, also with the following outfit: one pair of 4″ outside calipers, one 24″ brass bound rule graduated to $\frac{1}{16}$ inch; one pocket notebook, one pair of 3″ pencil point dividers, pencils and rubber, and last but not least, one "lunch box" (well filled of course). The plan of study is as follows: Each student is to attend with his outfit in the appointed shop from 9 A. M. to 4 P. M.; while he is to carefully study, and critically examine the machinery, tools or process which has been for that day the topic of the clinical lecture by the instructor, taking full notes and illustrating them by free hand sketches with dimensions in all cases.

Where the object is inaccessible (as roof trusses, etc.) dimensions are to be estimated by the eye and written approximately. Details of engines and machinery in process of construction, and which are easy of access, are to be drawn and described. Among these may be mentioned boilers, pistons, cross heads, cranks, pillow blocks, valves, wheel arms, connecting rods, etc., besides castings of any and all parts that may be of interest. All these are to be worked up into a descriptive illustrated paper, and handed to the professor on or before the first Monday of October, of the same year. The outlines of study are the general plan of shops or plant, traveling cranes, pivot cranes, hoists and tackling, telegraphs, principles of arrangement, structure of buildings, boilers, distribution of power, carpenter and pattern shop work, iron founding, forging, boiler shop work, metal working, machine tools, bench work, floor work, tool room systems, drawing office, and management of men. The students are required to go into the shop with a printed circular containing the above instructions in a more extended form, and at ten o'clock every morning Prof. Hutton delivers a practical lecture at the Quintard Iron Works upon the special subject under consideration, which generally occupies about 1½ hours' time. A lecture is delivered to the students at the Morgan Iron Works, at one o'clock every afternoon, so that the boys have an equal opportunity at each of the shops.

The class has been engaged in the shops since June 1, when the term closed. They will continue shop practice until July 1. The plans of superintending men, and the most advantageous ways of handling them, are freely discussed, and, on the whole, the plan adopted by Prof. Hutton seems to be fully up to any plan of instruction in engineering that we have seen thus far. An appropriation might very properly be made by the trustees of Columbia College for the purpose of defraying the expenses of students who cannot afford the extra expense incurred by this extra instruction, thus giving each student an equal opportunity.

Industrial Common School Education.

At this season the crops of students that have been ripening in our colleges and universities are being harvested at "Commencements" and sent away to feed the popular demand for educational progress. It is not our purpose to compare the present crop with that of preceding years, though there is an increase in the quantity if not the quality of the yield. Public attention is at this time directed by the daily and weekly press, in glowing language, to the great work that is being accomplished by our higher institutions of learning; but the number of youth who are privileged to pursue the prescribed course and graduate at these institutions is very small in comparison with the number whose educational advantages are limited to the common schools. The latter are seldom noticed by the leading daily newspapers, and even then very briefly. But our common schools deserve a far larger share of public notice than colleges and universities. Upon their efficiency, in a large degree, depends the social and industrial character of the country at large. The influence of the press and the public should be heartily given to the encouragement and improvement of our common schools. Methods of instruction should be scrutinized and every possible aid afforded to increase their efficiency. The main defect in most systems of school and college instruction is that they are pursued without any specific object in view. The need of particular industrial training in public schools is becoming every year more apparent. The demand for this class of instruction cannot be fully met by private endowed institutions. Cooper Institute in this city is performing a valuable work in this direction. We take the following pointed extracts from the last report of the Curator of that institution which we commend for thoughtful perusal.

Moral and industrial training in the common schools of the land—the system of schools being universal and compulsory, will prove the great engine for reform in this country.

It is generally assumed that brutality and ignorance, idleness and dissipation, criminality and pauperism, are confined, for the most part, among the poor and uneducated class of the community. This is a great mistake.

Such degrees of these moral delinquencies as come under the cognizance of law are confined to the poor and ignorant; but there is a vast amount of brutality, idleness and dis-

sipation, pauperism and crime, and the absence of the most useful and essential knowledge that belongs to the higher grades and governing classes in society. When a man or woman does not support himself or herself by fulfilling some useful and necessary function in society, either in administration or work, what is this but pauperism without beggary? When a man or woman disregards sentiments of honor, outrages feelings of humanity, tramples upon the weak and wrongs the innocent; robs and steals by professional devices and "tricks of the trade," what is he or she but a criminal in the sight of God and all honest hearts, though far beyond the reach of the law?

When a man or woman, "with the best intentions," does not know how to preserve his or her health, or the children's, in the ordinary conditions of life; "knows much of books but little of men;" much about literature and history, but little of Nature; is conversant with "letters and language," but knows not the alphabet of science or the elements of natural history—is not all this a very miserable ignorance of things essential to human happiness and progress?

"Ignorance" does not signify the absence of knowledge on every and all subjects, but of those the most essential to your position, opportunities and obvious duties. Is not this kind of ignorance very common among what are called the intelligent and even the "learned" classes?

This is the only kind of ignorance from which a well-regulated system of schools can protect our children; for we cannot teach our children everything.

Specific ignorance of things pertaining to your duties and necessities is far worse than "general ignorance."

The duties and necessities of the great mass of the people require what is called technical and industrial knowledge, and instruction in the use of tools, machinery, implements of all kinds for carrying on the arts and industries of civilized life Hence this is the kind of training and instruction that ought to prevail in our common schools.

The Master Car Builders' Convention.

The fourteenth annual convention of the Master Car Builders' Association was held in Detroit, Mich., June 8, 9, and 10. The first day's session was devoted to discussion on train brakes for freight cars, and the substitution of steel for iron and of iron for wood in car construction. A report on train brakes for freight cars was presented by the standing committee appointed to investigate that subject. The report states that in June, 1877, the first automatic brake, independent of all special connections between the cars, was brought to the attention of the Association. Since that time, twenty-two different devices designed for the same purpose, have been presented. Of these, eleven, it is claimed, operate independently on each car; two operate from either end of the train, and nine require a continuous connection throughout. Thus half of the inventions fulfill the main requirement in an automatic brake, as set forth by the committee some years ago, namely: capability of being applied to any one car independently of the other cars in a train. Few tests of these brakes have been made during the past year, but the committee express the belief that the adaptedness of some of them to the purposes in view will be demonstrated practically very soon, and that in the near future the competing railroads of the country will be equipped with an efficient train brake for freight cars.

Reference was made to a test of the Tallman brake, which had recently been made on the Pennsylvania road near Altoona. This brake is operated by friction from the axle. It utilizes the momentum of the train to stop it, and is automatic both backwards and forwards. The engineer has only to slack his engine and the brakes are applied by power communicated from the axle through a friction pulley and other mechanism to the brake levers. Each car is operated upon by the brake independently of every other car in the train. In the trial referred to, the brake was applied to five empty cars; there were five more empty cars on the same train unequipped with the brake; the train was run at a speed of twenty-two miles an hour, on a grade of fifty feet to the mile, and a stop was made within a little more than 500 feet. On a second trial, on the same grade, the brake stopped a train of twelve cars, five of which were loaded with 15 tons of coal each, and running at a speed of 19½ miles, in less than 650 feet.

The Card automatic brake was referred to approvingly by several members who had witnessed trials of it. It was described as a brake operated by centrifugal power, like the governors of an engine. The speed of the train will set the governor up to its proper position, so that it will throw a rod into a position to attach itself to a pin on the draw head; whenever the speed of the train exceeds seven miles an hour, this rod will be in position to hook on to the draw head and catch the brake. So long as it remains there (and the speed of the train continues until a pressure comes on to the draw bar) it will not operate. But as soon as the pressure comes on to the draw bar backward, the brake will take hold. The device is simple, and is said to cost but little and could be applied to a car probably for ten dollars. It was stated that on the road between Belleville and East St. Louis a stop was made by this brake on a hundred-foot grade in a little over 500 feet, but that was done by the application of the brake to the engine and the reversing of the engine itself. Several stops were made, all of which were satisfactory. It operates on each car independently, and, like the Tallman brake, is claimed not to interfere with the action of the hand brake.

The failure of the committee to lay before the Convention the results of any practical tests of the newly invented train brakes having been commented on with disapproval by some of the members, it was observed by one that so recently as 1876 the idea of a train brake for freight cars had been scouted as utterly impracticable, while now it is understood there are between forty-five and fifty devices of the sort which were worthy of consideration. This was ascribed in a large degree to the efforts of the committee—which had been appointed in the face of much opposition—in agitating the subject and bringing it to the notice of inventors throughout the country.

The committee on the substitution of steel for iron and of iron for wood in car construction, reported that the past year has not witnessed that progress in the line of substituting iron for wood in the building of cars that was expected, owing to the advance in the price of iron. The quality of timber is yearly deteriorating, and this will, sooner or later, lead to the substitution of iron for wood in car building. Iron body bolsters seem to be working their way into favor steadily; the natural tendency in substituting iron for wood is to make the iron needlessly heavy; the iron body bolsters now in use are capable of carrying over 100 tons of load per pair. While iron is over thirteen times stronger than green oak, it is less than seven times heavier. Therefore, a properly proportioned iron bolster should weigh but half as much as a green oak bolster of equal strength; but, as a fact, the iron bolsters in use are the heavier. The committee had no doubt that the truck of the future would be almost wholly of iron and steel; little has been done in this country toward producing and bringing into use an iron or steel car frame; in Europe, where lumber is more expensive, they claim to have reached a demonstration that iron is better, cheaper and lighter than wood for the bed of a car; as all the blows in ordinary traffic are received and delivered, and the weights carried on the bed of the car, there all the strength to resist blows and carry weight should be placed. If some one would invent a coating for sheet iron, which would protect it from rust, the chief obstacle to the introduction of iron cars would be removed With regard to the substitution of steel for iron in car construction, the committee found that almost nothing had been done. One trouble is, that manufacturers of steel demand high prices, and thus prevent the use of steel in car building. It is claimed that Bessemer steel can be produced more cheaply than pig iron; if this be true, the committee think there will be a break in prices before long, and mild grades of steel will displace iron for many uses.

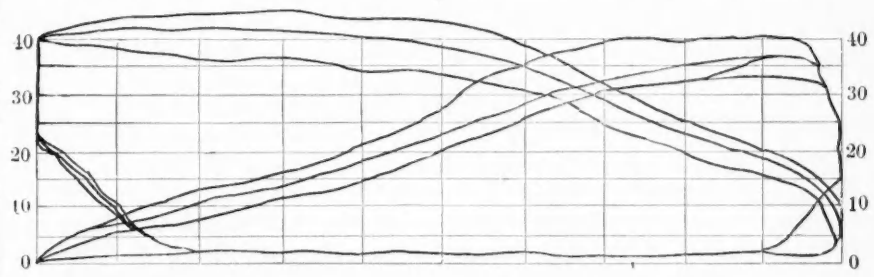
It was the opinion of one of the committee that one half in. by eight in. would be heavy enough to put under a sixteen-ton car in some conditions, while in others it would not. Body bolsters are now being put in that are an inch in thickness and six inches in width. They are supported by an under truss, which is supported by bolts and space pieces welded up at the ends and bolted up, and what one of these will carry is something tremendous. The size will depend on the height of the arch and the number of space pieces. The tendency in using iron for such purposes is to make it too heavy. The thinner the iron is rolled, other things being equal, the better it is; the thicker it is, the nearer it approaches to muck bar.

It was reported that there are a good many cars equipped with iron bolsters, and it is thought they were doing good service.

It was suggested that a paper board now manufactured could be used instead of wood and sheet iron on cars.

In relation to running gear, some favored an iron truck, but thought that its utility on lines having many short curves would not be so great as on straight lines like the Canada Southern.

A committee of three were appointed to confer with a similar committee of the Master Mechanics' Association to investigate the present standards of what are known as the master-car builder's standard journal bearing, journal box and pedestal, and that committee are to report whether any changes from the present standards are desirable.



Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1.) C. C. H. Manayunk, Philadelphia, Pa., writes: Enclosed please find cards taken from a 16x24" vertical engine, revolutions per minute=100, pressure on steam gauge=50 pounds. The cards were taken by a Richards indicator. Will you please work up these cards according to the data above given; also explain to me the rule for deducting the percentage of average pressure absorbed by the engine, or, after I have ascertained the average pressure as shown on these cards, what pressure must I deduct for losses in, or to get the effective pressure? *A.*—The scale of the cards referred to by the illustration is evidently 32 pounds, and shows an average mean effective pressure (M.E.P.) as follows: The M.E.P. of the three diagrams from the top end of the cylinder measures by the planimeter 28.8 pounds, and those from the lower end 18.6 pounds. Average M.E.P. per revolution is 23.7 pounds. Whence the H.P.= $\frac{201\times4\times100}{33000}\times23.7=2.44\times23.7=57.8$ H.P. The eccentric rod should be lengthened to equalize the cut-off, and load both ends alike. There is no rule for determining the efficient power given off on the belt from knowing the indicated power. It is entirely a matter of experience, or perhaps more justly of opinion, since there are no very definite experimental data on the subject. The design of engine as to size of bearings, length of connections, etc., as well as its condition, has much to do with it. Moreover, the percentage of power absorbed varies with the size of engine, being less with large engines. It is probable that the loss will vary for 3% on large engines to 7% or 8% on small ones. Indicated H.P. is very generally adopted as the standard of measurements.

(2.) E. A. M, Battle Creek, Mich., writes: In your remarks about "Grounding Theory in Practice," page 8, May 29, 1880, you mention a system for taking copies from drawings called the Solar process: Will you be kind enough to tell me how this is done, or where I can get the information? *A.*—To prepare the solution for copying tracings, procure 2 oz. of the "citrate of iron and ammonia," also 1 oz. "red prussiate of potash," and 16 oz. water. Place half the water in two separate vessels and dissolve the citrate of iron and ammonia in one, and the red prussiate of potash in the other; when dissolved, mix the contents of the two vessels, and place in a very dark yellow or black bottle, and keep in a dark place. For copying, any quality of paper may be used that will stand washing without being torn, white being preferable. The solution is to be applied to the surface of the paper with a sponge, and the tracing to be copied is to be spread over the paper. The paper should rest upon a soft substance—a woolen army blanket will do very well—and place a square of plate glass over the whole to keep the drawing smooth. The time required to complete the process is from 2 minutes to 30 minutes, according to the strength of the light, as the process is nothing more nor less than photography. When the process has become complete the lines upon the paper will appear white. There is a tendency on the part of beginners to let the drawing remain too long, for fear of not getting a good copy; thus they overdo the thing and fail. The action of the light has the effect of rendering the solution insoluble, so that the parts which are not exposed to the light (under the lines of the drawing) will readily be dissolved and washed away. After the copying process is finished, the copy is to be taken from under the glass and washed, by dipping in clean water from 3 to 15 minutes, then allowed to dry upon a flat surface. By a little practice any one may do very satisfactory work by this process.

(3) A. S. Sherbrooke, P. Q., writes: We have had a controversy about expansion and contraction. I claim that a piece of wrought iron 3" square will have the same expansion as a piece ½" square with equal heat and equal length, also that a 3" steam pipe will expand the same as a 1" steam pipe, with equal heat and length. I was asked to write you for your opinion. *A.*—We would say that expansion and contraction is caused simply by the different arrangement of the molecules which compose the iron, and that two pieces of iron, whether a bar or tube, of exactly the same quality, will expand and contract equally when subjected to exactly the same temperature. If two pieces of iron of a different quality were used for the test, we would expect to find a variation, owing to the difference in the number and arrangement of the molecules which form the grain of the iron.

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See Christiana advertisement next number.

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Second-hand 80 H. P. Tubular Boiler for sale cheap; also one large Blower. David W. Pond, Worcester, Mass.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

MANUFACTURES.

Acker & Co., of Phœnixville, Pa., are erecting a new foundry for the manufacture of hardware specialties.

Armstrong, Dixon & Co., of Philadelphia, will erect a paper and pulp mill at Lock Haven, Pa.

The Hampden Foundry and Machine Company, 7 Exchange place, Boston, have recently filled an order for Wright & Moody, confectioners, Cornhill, Boston, for one of their patent feed water heaters.

A silk mill is to be located in the old watch factory at Marion, N. J., and 500 frame houses are about to be erected for the hands. New machinery for the mill is now being manufactured.

A complete set of machinery for a woodworking shop, with shafting etc., and including a workman to set it up, was recently sent from Boston to Amsterdam, Holland. Woodworking machinery has formerly been sent abroad in pieces, but this is the first instance in which an entire shop has been shipped. The demand for American machinery in Holland is said to have been caused partially by the exhibit of American manufactures at the fair in Antreim last summer.

We learn from the Holyoke, Mass., *Hera'd* that James Emerson has sold his interest in the testing flume at that place to the Holyoke Water Power Co. Mr. Emerson will receive no more wheels to test after July 1st, but the company will continue the use of the flume.

The Chester Furnace Company has begun the foundation work for its new blast furnace at South Chester, Pa. The furnace building will be 70x60, with an engine house 50x90. The casting department will occupy 150x60, and the stock house is to be 400 feet long.

New flouring mills are to be built in Minnesota at Sand Creek, Breckinridge, Nicollett station and Watertom.

We have received the following from Mr. Joseph G. Harrison, Treas. of the Tubular Barrow and Truck Manufacturing Co., of Jersey City: I notice in your issue of June 26th the statement that the Erie City Iron Works, of Pa., have taken a contract to supply the iron work for Hudson River Tunnel, and that the material is being furnished by Carmichael & Emmens. This is not correct. The Erie City Iron Works contracted for 300 tons of the iron casing, the material for which was furnished by Messrs. C. & E. The Tubular Barrow and Truck Manufacturing Co., Fourteenth street, Jersey City, have contracted for 500 tons of tunnel casing, the material for which is being furnished by D. F. Cooney, 88 Washington st., N. Y. City.

Glass railway ties having, as it is claimed, proved a success, the inventors are becoming enthusiastic over glass as the coming substitute, not only for wood but also for iron. They now propose to make the track of street railways of this material, using broad longitudinal sleepers of glass, having a groove in the upper surface, and, so combining in themselves the functions of both sleepers and rails, do away with the necessity for separate iron rails, with their fastenings, joints, and other complications. It is further believed that by properly tempering glass with oil, this very brittle substance can be made, mass for mass, stronger than steel, and practically unbreakable. Is the age of glass to succeed that of steel? Paper has proved a very useful substitute for iron in some positions, and it is possible that our ideas of the eternal fitness of things are to be entirely subverted.—*Rai'way Review.*

The saw and planing-mill of Jarvis & Bensinger at Winnipeg, Minn., were blown to pieces lately by the explosion of the steam boiler. Several persons were seriously injured, four of them fatally. The cause is supposed to be the injection of cold water into the boilers, which were only two years old. The loss is $6,000. The mill will be rebuilt at once.

In the Pennsylvania Railroad's shops at Altoona, Pa., a machine is in operation to separate iron and brass filings which fall from the lathes. It is done by magnets on the principle that a common magnet attracts wrought iron strongly, cast iron lightly, and brass not at all. It is pronounced a success.

A ninety inch cylinder for one of the new cotton compresses being built at the Fulton Iron Works, St. Louis, was successfully cast a few days ago. It will be three inches thick when finished, ten feet long, and weighs 32,000 pounds.

Bangor Furnace, at Bangor, Van Buren county, Mich., recently made 324 gross tons of hot blast pig iron in seven days.

At the Rhymney Iron works in Wales, a powerful reversal engine for rolling steel rails has been placed in position, and it is claimed that by its aid, with less hands, the work of one mill can be doubled, enabling it to turn out 2,000 tons of steel rails weekly.

The Baldwin Locomotive works have built more than 5,000 locomotives, and these with their tenders if put in line would make a train over forty miles long.

The sheet mill and both the rolling-mills in New Castle, Pa., are in operation. The rolling mills have been running since Monday last. Of the seven blast furnaces here four are in blast.

Business has of late become so brisk that the Indianapolis rolling mill is about two months behind its orders. For some time past they have been working a full force of hands, both night and day.

Fieldler, Moeldner & Co., of Boston, silk manufacturers, have just purchased about 15,000 feet of land, situated on the Highlands, and will erect an extensive factory for the manufacture of silk trimmings, fringes, etc.

The Ulster County Knife Works were lately burned at Ellenville, N. Y. Ninety hands were thrown out of employment. The loss is $25,000 with $15,000 insurance. The works were rushed with orders. It is not settled whether they will be rebuilt at Ellenville or some other point.

A Merrimacport (Mass.) inventor has produced something new in the way of pail-making machinery. This machine makes the sides of a pail in one piece; it takes a block of wood shaped like a water pail, and cuts a strip off round it the proper thickness for a pail, and as long as the block will make. A piece of this is cut off the right length, the edges tongued and grooved, and a groove cut to receive the bottom. It is claimed that 600 pails can be turned out daily by this process.

The Cherry Valley Iron Company, of Leetonia, O., have just completed the laying of an eight-inch cast iron pipe from their furnace to their rolling mill, a distance of 300 yards, through which to convey steam to operate the machinery of the latter.

The Vulcan Iron Works, Chicago, are just completing a car pile-driver for the St. Paul, Minneapolis & Manitoba Railroad Co., to be used for railroad pile-driving along the line of the above road, with a 20,000-pound hammer. This firm are also manufacturing a Loomis patent steam hammer for the Chicago Dredging and Dock Co., and a Skinner patent hammer for O. B. Green. They are employing seventy-five hands and running over time.

The new oil manufactory building near Jefferson avenue and the Missouri Railroad, St. Louis, Mo., is completed, and the machinery rapidly being put in working order.

The capital stock of the Wood Mowing Machine Co., Hoosick Falls, N. Y., has been increased from $1,000,000 to $1,500,000.

The J. Esty & Co. Organ Works, at Brattleboro, Vt., are being enlarged so as to admit of a one-third larger production, and 1,200 organs will be manufactured each month.

In our last issue a blunder was made, owing to the pressure of business just before going to press. The cuts accompanying Mr. Woodward's article on "The Multiple Port System of Valve Gear," which appeared on pages 6 and 7, were not the correct ones. We will print the correct cuts to accompany that article next week.

Machinists' and Engineers' Supplies.

NEW YORK, June 17, 1880.

The market is about as devoid of special interest as at any other time since the beginning of the year.

Prices are, as a rule, without change, but some revisions may be looked for about the first of July

The unsettled condition of the iron market has anything but a favorable effect upon the machinists' supply trade, though prices are well maintained.

N. F. Burnham, York, Pa., has just issued a 100 page illustrated pamphlet of his Standard Turbine Water Wheel, with special information for users of water power.

The American Lubricator Co., Detroit, Mich., have issued an illustrated pamphlet of their American Lubricator for Steam Engines. Cuts show this device attached to a number of the leading engines.

Iron Review.

NEW YORK, June 17, 1880.

There are but few sales of large lots of pig iron owing to the uncertain condition of the market. Founders are buying only for immediate use, and seem to have but little confidence in the stability of prices. We quote nominally No. 1, $23 to $25; No. 2, $22 to $23; grey forge, $20; Eglinton, $20 to $21; Coltness, $23; Glengarnock, $21 to $23; and Gartscherrie, $22. Trade in finished irons out of store is good considering the state of the pig iron market and the summer season. There appears to be a growing feeling that the decline can not be continued much longer and must be followed by an upward movement before fall.

Pierson & Co., 24 Broadway, N. Y., under date of June 17, 1880, quote prices out of store as follows:

Iron Rails, $50 to $57, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3¾c.; Common Bar Iron, 2.5c., basis from store; Refined do. 2.7c., basis; Ulster, 3.6-10c. basis; Machinery Steel, 6¼c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c; Nail Rods, 6¾c.; Sheet Iron, 3¾c., basis; Angle Iron, 3.5c.; Tee Iron, 4c.; Band Iron, 3½c.; Hoop Iron, 3 7-10c., and up according to size; Horse Shoe Iron, 3½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies as follows:

Flange, 4¾c.; C. H. No. 1 Shell, 3½c.; Tank, 2¾c.; C. No. 1, 3¼c.; Boiler Tubes, 50% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of June 17th, 1880:

A decidedly better tone pervades the Metal Market. Pig Tin is in good demand, and the seeming large stocks have been materially reduced. London quotes: Straits, £77; "buyers and no sellers." Singapore, $23. We quote the Spot Market nominally today: Banca Tin, 21½c.; Malacca and Straits, 17c. to 17½c.; Australian and English Refined, 16¾c to 17c.; Billiton, 16¾c.; Lamb and Flag 16½c. to 16¾c.; Pig Lead 5c.; Antimony, Cookson, 19c.; Hallett, 17½c.; Spelter, 5½c. and 5¾c. for Domestic; 6c. for Silesian; Ingot Copper 18⅛c. to 18¾c.; Nickel, $1.25; No. 1 Solder 10c.; "half-and-half" 11½c.

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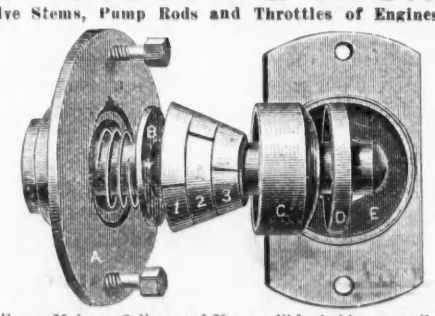

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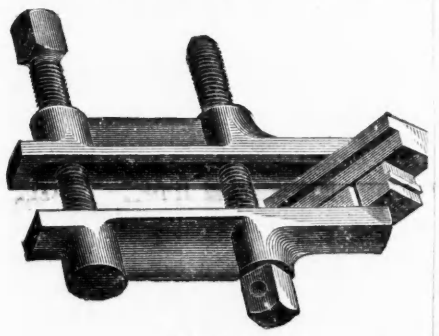

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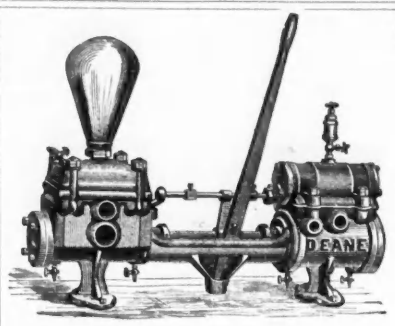

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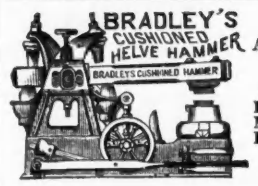

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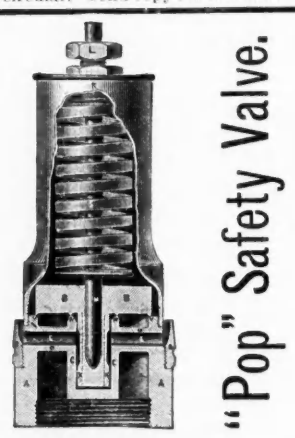

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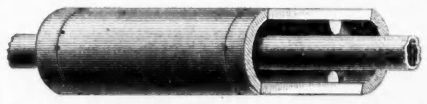

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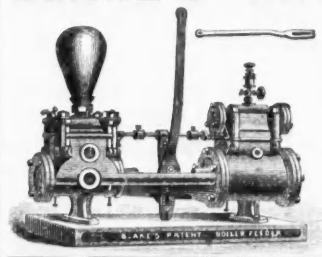

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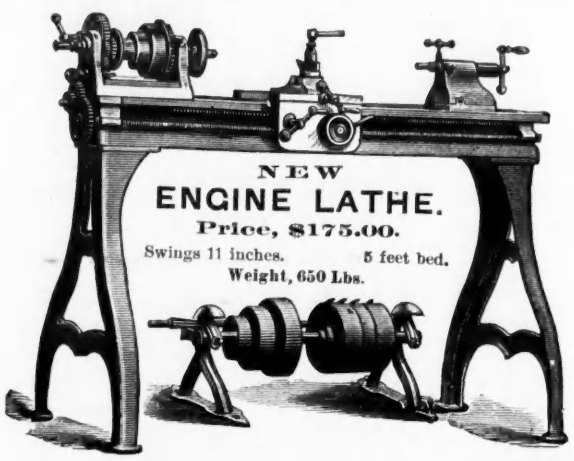

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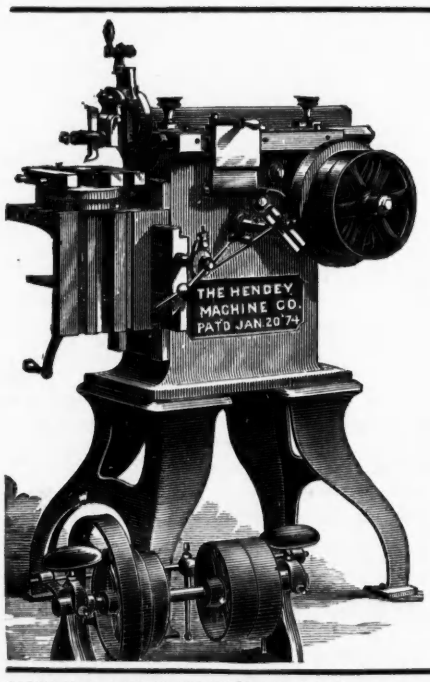

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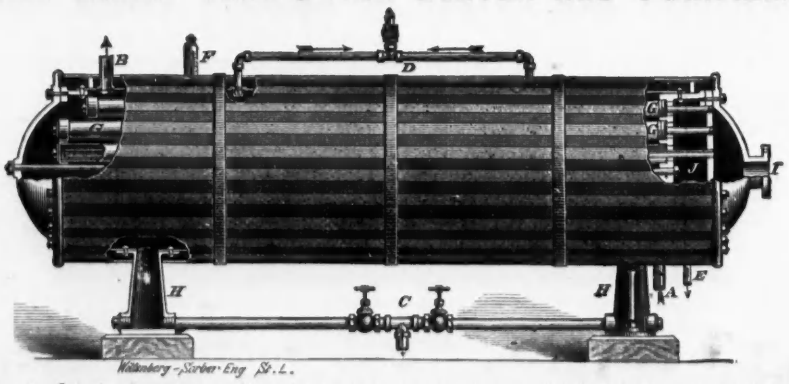

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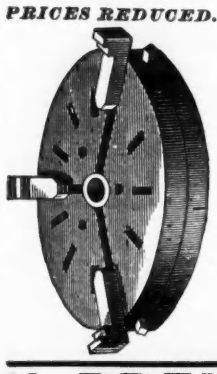

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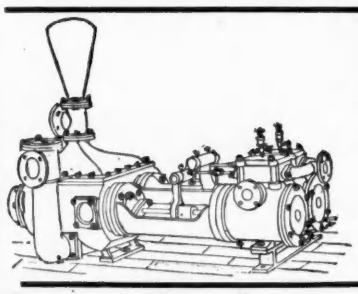

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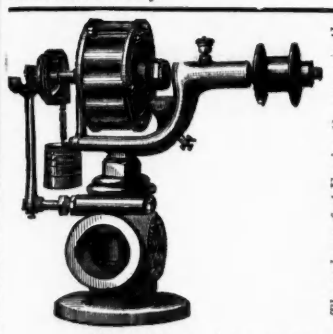

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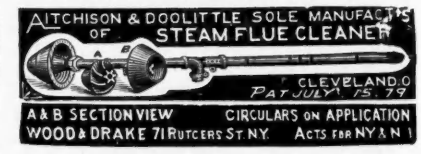
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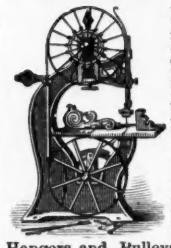

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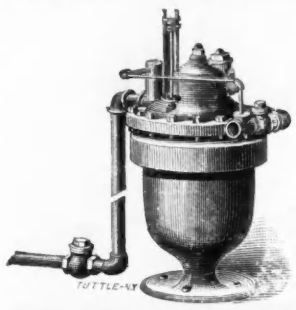

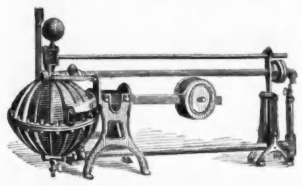

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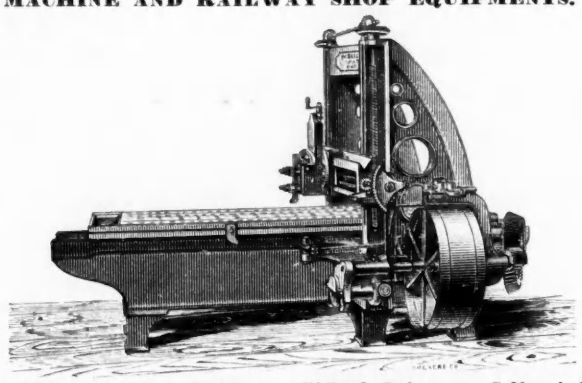

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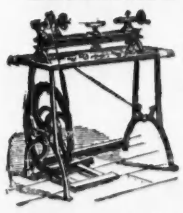

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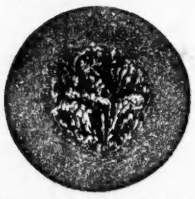

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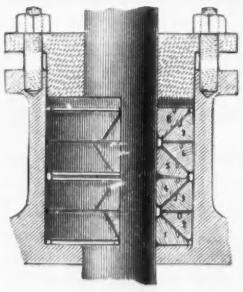

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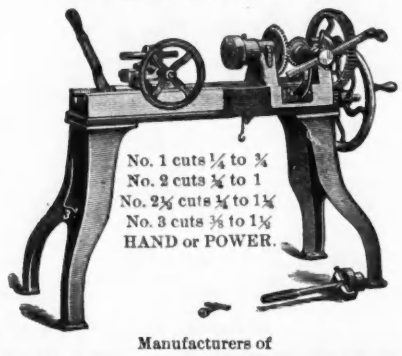

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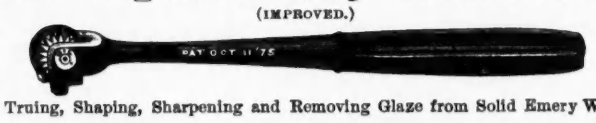

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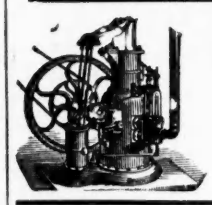

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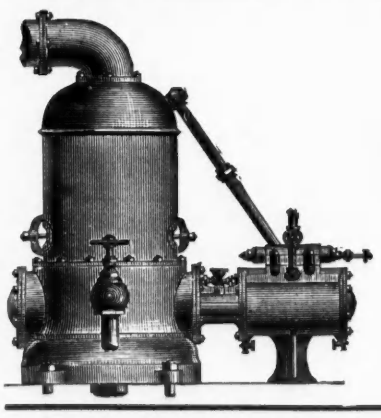

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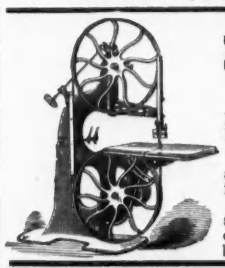

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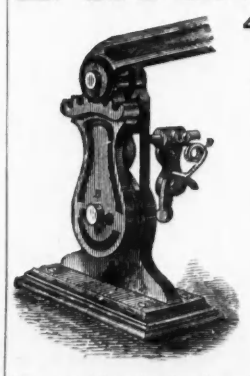

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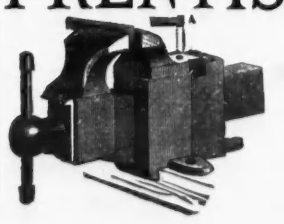

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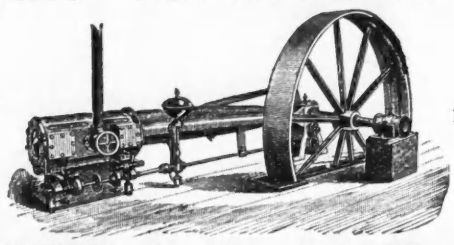

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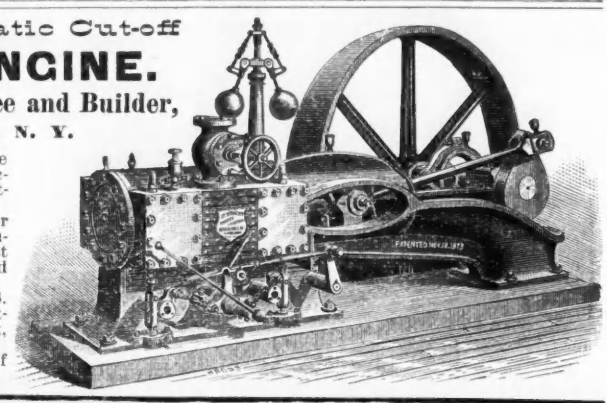

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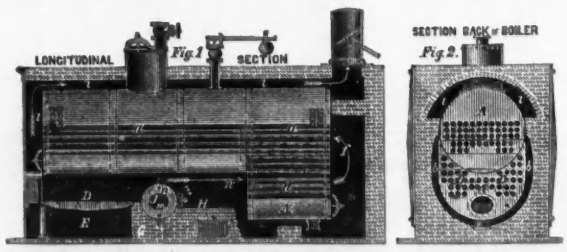

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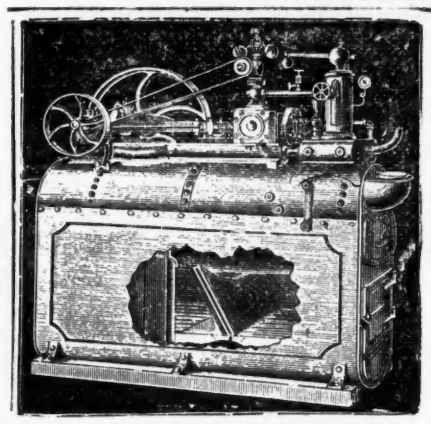

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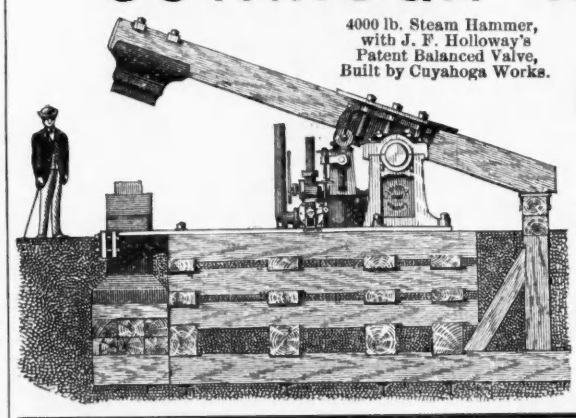

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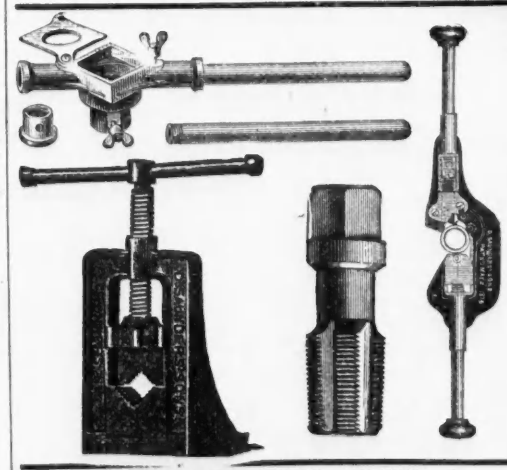

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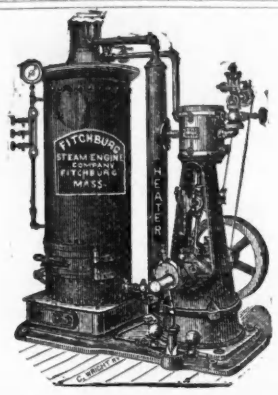

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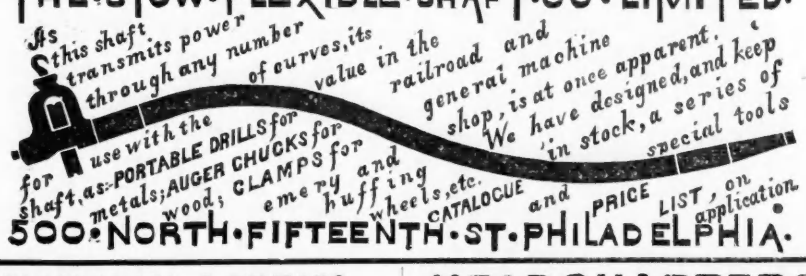
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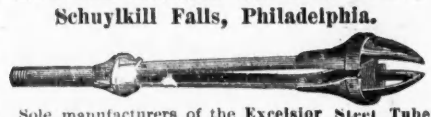

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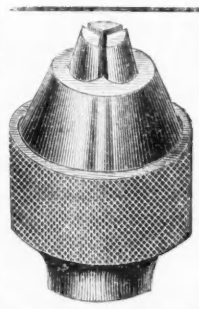

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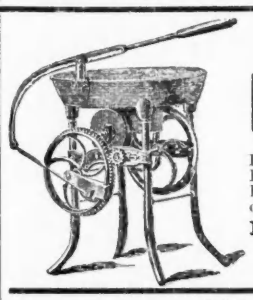

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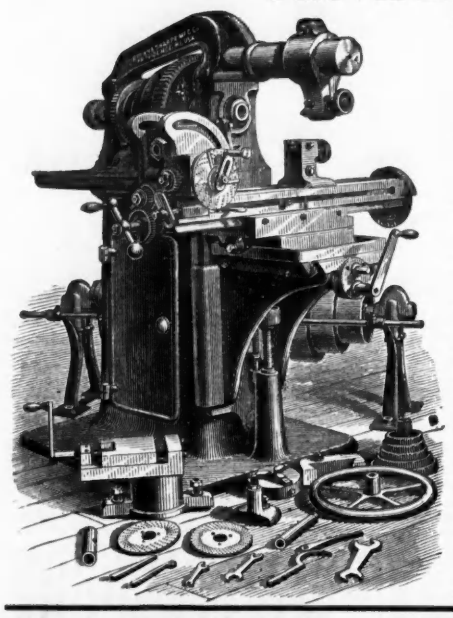

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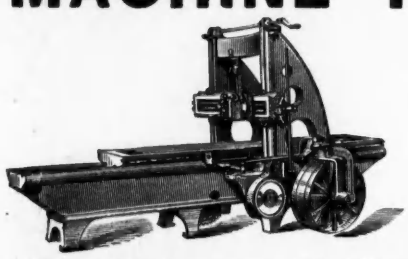

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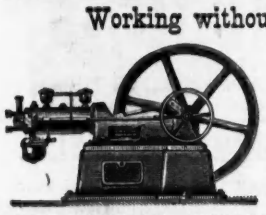

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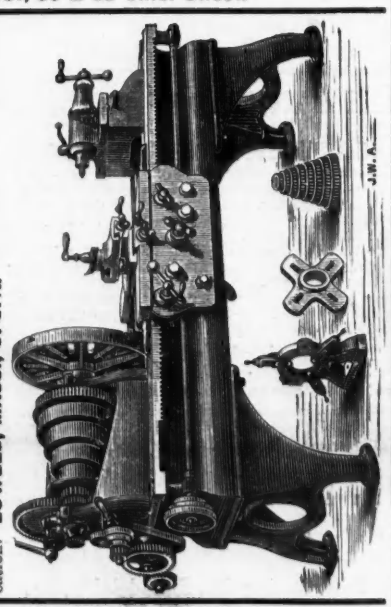

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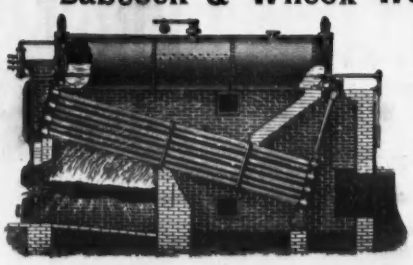

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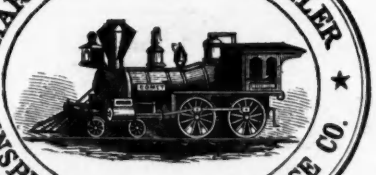

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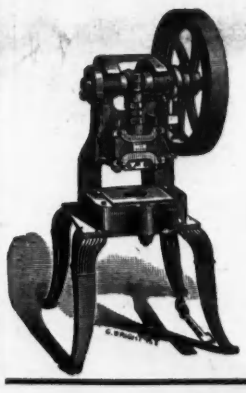

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